

SOME BATHONIAN OSTRACODA OF ENGLAND
WITH A REVISION OF THE JONES 1884 AND
JONES & SHERBORN 1888 COLLECTIONS

BY

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SYNOPSIS

Three Bathonian ostracod Collections from the Fuller's Earth Clay of Bath, Somerset, and one of similar age (the T. R. Jones Collection, published in 1884) from the Richmond borehole, Surrey, are described and illustrated, that of J. F. Blake for the first time. The H. H. Winwood Collection is identified as syntypic material of the T. R. Jones & C. D. Sherborn Collection, published in 1888. Sixty-three ostracod species are described of which six are new, and six are left under open nomenclature. Nineteen species are listed as lost. Two genera, *Hadrocytheridea* and *Hekistocythere*, are new.

I. INTRODUCTION

IN 1884 T. R. Jones described the foraminifera and Ostracoda from a deep boring at Richmond, Surrey. The ostracods were described from three levels and, apart from *Pontocyprrella harrisiana* and *Schuleridea jonesiana* which are Cretaceous contaminants of the collection, are Bathonian in age.

Four years later, Jones & Sherborn (1888) described a much larger ostracod fauna from the Bathonian of Midford, near Bath. The samples of Blue and Yellow Fuller's Earth Clay were given to Jones and Sherborn by the Rev. H. H. Winwood (see Jones & Sherborn 1886).

The collections of Jones 1884, and of Jones & Sherborn 1888, are of considerable importance for present-day work. Because of this it is proposed here to re-describe and re-illustrate the species and to designate types where necessary; a few species originally described by Jones & Sherborn are missing from the collections and are presumed lost.

Two additional collections from the Fuller's Earth of Midford, near Bath, are included because they add to the faunal list and in the case of the Blake collection record the presence, for the first time in England, of a number of species previously only described from N.W. France (Oertli 1959). The most important of the collections, however, is that presented by the Rev. H. H. Winwood. A label stating that

these specimens are duplicates of the originals figured in 1888 was left with the collection by C. D. Sherborn. As the specimens figured by Jones & Sherborn were extracted from material given them by Winwood, there would appear to be no doubt that this collection represents syntypic material.

The Fuller's Earth Clay of Midford, near Bath, was placed by Arkell (1956 : 28) in the *Oppelia aspidoides* Zone. Torrens (1967 : 83), however, assigned it to the zone of *Prohecticoceras retrocostatum*, basal Upper Bathonian and below the *aspidoides* Zone.

The terminology and classification employed throughout this paper are those of Moore (1961) and Bate (1963). All the material described is in the Department of Palaeontology, British Museum (Natural History).

II. THE T. R. JONES COLLECTION

Order PODOCOPIDA Müller 1894

Suborder PLATYCOPINA Sars 1866

Family **CYTHERELLIDAE** Sars 1866

Genus **CYTHERELLA** Jones 1849

Cytherella symmetrica Jones

(Pl. 1, figs. 1, 2)

1884 *Cytherella symmetrica* Jones : 768, pl. 34, fig. 42.

1884 *Cytherella subovata* Jones : 773, pl. 34, fig. 43.

DIAGNOSIS. *Cytherella* with elongate-oval carapace. Left valve uniformly overreached by larger right valve. Greatest height of carapace in posterior third. Shell surface very finely punctate. Dimorphic: Adult female of length 0.85 mm., male of length 0.90 mm.

LECTOTYPE. IN.43503, female right valve; Richmond boring, depth 1,151 ft. 6 ins.

PARALECTOTYPES. IN.43496, male left valve, and I.941, female carapace; depth 1,205 ft.

DESCRIPTION. Both left and right valves are elongate-oval in outline with well-rounded anterior and posterior margins. Ventral margin straight to slightly convex, dorsal margin strongly convex in the posterior third (region of greatest height) but straightens out anteriorly. Greatest length through mid-point. Right valve larger than the left which it overreaches evenly all-round. Shell surface very finely punctate, though the state of preservation does not always show this. Selvage in the left valve strongly developed to form a ridge which fits into a corresponding groove in the right.

DIMENSIONS. IN.43503. Female right valve and lectotype of *Cytherella symmetrica* Jones, length 0.85 mm.; height 0.52 mm. IN.43496. Male left valve and

lectotype of *Cytherella subovata* Jones, length 0.90 mm.; height 0.50 mm. I.941. Female carapace, length 0.77 mm.; height 0.49 mm.; width 0.36 mm.

REMARKS. The figured specimens of *C. symmetrica* and of *C. subovata* are missing from the Jones Collection and are presumed lost. Unfigured syntypes have therefore been selected as lectotypes. *C. subovata* has been recognized as the male dimorph and *C. symmetrica* as the female dimorph of the species *Cytherella symmetrica*.

Oval species of *Cytherella* look very much alike, and *C. symmetrica* is very similar to *C. suprajurassica* Oertli (1957 : 649, pl. 1, figs. 1-10). The latter, however, is a smaller species with a greater mid-dorsal projection of the right valve over the left. In *C. symmetrica* the overreach of the right valve is much more uniformly developed along the entire dorsal margin.

Genus *CYTHERELLOIDEA* Alexander 1929

Cytherelloidea jugosa (Jones)

(Pl. 1, figs. 3, 4; Text-fig. 1)

1884 *Cytherella jugosa* Jones : 773, pl. 34, fig. 44.

DIAGNOSIS. Carapace sub-rectangular in outline with broadly rounded anterior and posterior margins. Ventral margin strongly incurved. Ornamentation consists of a broad peripheral ridge and a thick, central sigmoid ridge. Shell surface finely punctate.

LECTOTYPE. IN.43497, female right valve (figured Jones 1884); Richmond boring, 1,205 ft.

PARALECTOTYPE. I.2311, female carapace; Richmond boring, depth not recorded.

DESCRIPTION. Carapace sub-rectangular in outline with well rounded anterior and posterior margins. Dorsal margin broadly convex with a slight concavity just anterior of mid-point. Ventral margin strongly incurved. Greatest length through mid-point; greatest height median, despite the strong concavity of the ventral margin. Greatest width at the posterior margin. The two specimens available are female dimorphs possessing two posterior swellings, of which the lowermost is the more prominent. Shell surface finely punctate, further ornamented by a broad peripheral ridge extending completely around each valve and enclosing a sigmoid inner ridge which commences at the anterior inner edge of the peripheral ridge, bends upwards, then curves down below the mid-dorsal muscle scar depression, finally curving upwards again to die out before reaching the peripheral ridge in the region of the postero-dorsal angle. Right valve larger than the left, which it overreaches anteriorly and overlaps ventrally and dorsally, especially anterodorsally where there is a slight concavity in the margin. Only internal details of the right valve observed: **Muscle scars** situated on a slightly raised dorso-median boss, are typical of the genus; a groove extends around the posterior and along the dorsal margin for the reception of the left valve. Two posterior cavities correspond to the swellings seen on the outside of the valve.

DIMENSIONS.

IN.43497. Female right valve, length 0.55 mm.; height 0.30 mm.

I.23II. Female carapace, length 0.56 mm.; height 0.34 mm.; width 0.23 mm.

REMARKS. *C. jugosa* is similar to *C. paraweberi* Oertli (1957 : 651, pl. 1, figs. 12-15) but differs in being rounded rather than angular postero-dorsally, in being more noticeably constricted mid-dorsally, and in being narrower anteriorly where only the right valve tends to project. Laterally, the ribbing of *C. jugosa* is very much broader. A weak reticulation may be observed in *C. paraweberi* on the lateral surface.

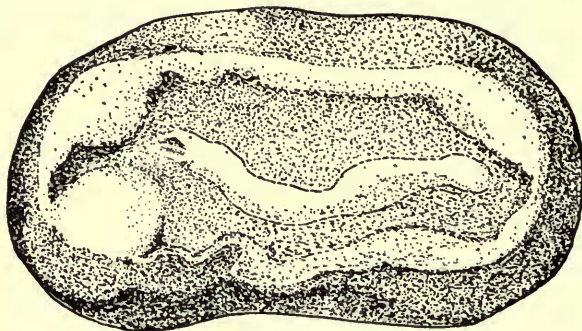


FIG. 1. *Cytherelloidea jugosa* (Jones). Female right valve. Lectotype IN.43497. $\times 135$.

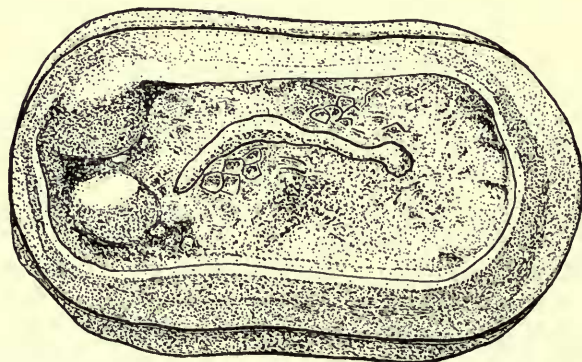


FIG. 2. *Cytherelloidea paraweberi* Oertli. Right side, female carapace, Io.3527. $\times 130$.

Stratigraphically, *C. jugosa* predates *C. weberi* Steghaus (1951 : 207, pl. 14, figs. 3-6) and *C. paraweberi* Oertli, both of which appear to be restricted to the Kimmeridgian. The close similarity in ornamentation between these species suggests a phylogenetic relationship (Text-figs. 1, 2). This is probably also true for the Bajocian species, *Cytherelloidea eastfieldensis* Bate (1963a : 25, pl. 1, figs. 1-5, Text-fig. 1) which is easily distinguishable by the mid-dorsal discontinuity of the peripheral ridge.

Suborder PODOCOPINA Sars 1866
 Superfamily **BAIRDIACEA** Sars 1888
 Family **BAIRDIIDAE** Sars 1888
 Genus **BAIRDIA** McCoy 1844

Bairdia hilda Jones

(Pl. 1, figs. 5, 6; Pl. 4, fig. 5)

- 1884 *Bairdia hilda* Jones : 771, pl. 34, fig. 20.
 1888 *Bairdia fullonica* Jones & Sherborn : 253, pl. 5, fig. 4a-c.
 1948 *Bairdia* cf. *hilda* Jones; Sylvester-Bradley : 199, Text-fig. 5.
 1963 *Bairdia hilda* Jones; Bate : 188, pl. 2, figs. 9-12, pl. 3, figs. 1-4.
 1964 *Bairdia hilda* Jones; Bate : 8.

DIAGNOSIS. Carapace subdeltoid laterally, strongly convex dorsally. Dorsal margin high with steeply inclined anterior and posterior slopes. Posterior end acuminate, upturned. Shell surface finely punctate.

LECTOTYPE. IN.41951, single left valve figured Jones (1884) Richmond boring, depth 1,205 ft.

PARALECTOTYPES. Io.3608-16 and Io.3620-6, carapaces and single valves from a depth of 1,205 ft.

REMARKS. Full descriptions of this species have been given previously by Sylvester-Bradley (1948) and Bate (1963). However, as the measurements of the types were not included these are given here.

DIMENSIONS. IN.41951, left valve, length 0.93 mm.; height 0.48 mm. Io.3608, carapace, length 0.77 mm.; height 0.48 mm.; width 0.34 mm. Io.3610, carapace, length 0.90 mm.; height 0.47 mm.; width 0.34 mm.

Bairdia juddiana Jones

(Pl. 1, fig. 7)

- 1884 *Bairdia juddiana* Jones : 767, pl. 34, fig. 18.

DIAGNOSIS. Carapace globose, convex in dorsal view. Shell surface finely punctate. Antero-dorsal and postero-dorsal slopes convex. Left valve distinctly overlaps the right along the dorsal and ventral margins, particularly mid-ventrally. Caudal process slightly upturned. Ventral margin angled with flattened median portion and steeply sloping antero-ventral and postero-ventral slopes.

HOLOTYPE. IN.43506, carapace, figured Jones (1884), Richmond boring, depth 1,151 ft.-1,151 ft. 6 in.

DESCRIPTION. Carapace rather globose in lateral view with convex antero-dorsal and postero-dorsal slopes. Anterior end rounded, posterior end with caudal process slightly upturned although damaged in the specimen available. Dorsal margin

with convex central section and steeply sloping antero-dorsal and postero-dorsal slopes. Greatest length of carapace through the mid-point; greatest height and width slightly anterior to the mid-point. Left valve larger than the right which it overlaps along the entire dorsal and ventral margins and overreaches slightly at the anterior margin. Shell surface finely punctate. Internal features not known.

DIMENSIONS. IN.43506, carapace, length 0.85 mm.; height 0.59 mm.; width 0.46 mm.

REMARKS. *Bairdia juddiana* is sufficiently distinct for the single carapace to be considered a separate species; it differs from *B. hilda* in being shorter, higher and more strongly convex in dorsal view. The postero-dorsal slope of *B. hilda* is more strongly concave than that of *B. juddiana* which lacks the slight anterior upturning of the antero-dorsal slope seen in the former.

Bairdia jurassica Jones

(Pl. 2, figs. 1, 2)

1884 *Bairdia jurassica* Jones : 771, pl. 34, fig. 21.

1884 *Bairdia jurassica* var *tenuis* Jones : 771, pl. 34, fig. 22.

DIAGNOSIS. Carapace elongate, drawn out, with acuminate slightly upturned caudal process. Dorsal margin broadly arched with obliquely sloping antero-dorsal and postero-dorsal slopes. Left valve larger than the right which it overlaps antero-dorsally, postero-dorsally and mid-ventrally. Postero-ventrally, the left valve turned outwards to reveal margin of right valve. Shell surface very finely punctate.

LECTOTYPE. IN.43494, figured Jones 1884, pl. 34, fig. 21, Richmond boring, depth 1,205 ft.

PARALECTOTYPES. IN.43495, figured Jones 1884, pl. 34, fig. 22, and Io.3617, carapaces from depth 1,205 ft., Richmond boring.

DESCRIPTION. Carapace drawn out, elongate, greatest length just below mid-point. Greatest height and width just anterior to mid-point. Dorsal margin broadly arched with the antero- and postero-dorsal slopes obliquely inclined and only slightly convex. Anterior end rounded, posterior end acuminate, not prominently upturned. Ventral margin broadly convex, almost straight. Left valve larger than the right which it overlaps along the antero-dorsal and postero-dorsal slopes, especially towards the extreme anterior, and posteriorly along the caudal process. Left valve overlap prominent mid-ventrally; left valve very noticeably turned outwards postero-ventrally from the right to reveal the margin of the right valve. Shell surface finely punctate. Internal features not seen.

DIMENSIONS. IN.43494, carapace, length 0.85 mm.; height 0.39 mm.; width 0.31 mm. IN. 43495, carapace, length 0.93 mm.; height 0.40 mm.; width 0.34 mm. Io.3617, carapace, length 0.88 mm.; height 0.43 mm.; width 0.30 mm.

REMARKS. From the dimensions given above it can be seen that the variety *tenuis* is more elongate than the other two specimens. Some variants of *Bairdia hilda* Jones are similar to the present species which may be distinguished on the shape of its carapace and the type of overlap by the left valve.

Superfamily **CYPRIDACEA** Baird 1845

Family **PARACYPRIDIDAE** Sars 1923

Genus **PONTOCYPRELLA** Ljubimova 1955

Pontocyprella harrisiana (Jones 1849)

(Pl. 2, fig. 3)

1849 *Bairdia harrisiana* Jones : 25, pl. 6, figs. 17a-f.

1884 *Macrocypris bradiana* Jones : 766, pl. 34, fig. 23.

For a full synonymy of Cretaceous forms see Kaye 1965 : 73.

MATERIAL. IN.43500, left valve figured Jones (1884), depth 1,145 ft. 9 in.-1,146 ft. 6 in.

REMARKS. Jones (1849 : 25) first recorded this species as *Bairdia harrisiana* from a number of horizons, but typically from the Cretaceous (Gault, Leacon Hill; Chalk, Gravesend and Charlton; Detritus, Charing and from the Speeton Clay, Yorkshire).

The presence of this species at a depth of 1,145 ft. 9 in.-1,146 ft. 6 in. in the Richmond bore indicates that some contamination of the cored material has occurred. As Jones himself originally described *P. harrisiana*, it is somewhat surprising that he failed to recognize it here.

DIMENSIONS. IN.43500, left valve, length 0.88 mm.; height 0.42 mm.

Superfamily **CYTHERACEA** Baird 1850

Family **SCHULERIDEIDAE** Mandelstam 1959

Subfamily **SCHULERIDEINAE** Mandelstam 1959

Genus **SCHULERIDEA** Swartz & Swain 1946

Schuleridea (Schuleridea) jonesiana (Bosquet)

(P.1 2, fig. 5)

1884 *Cytheridea subperforata* Jones : 772, pl. 34, fig. 26, [not p. 768, pl. 34, fig. 25].

For the synonymy of the Cretaceous forms see Kaye 1964 : 45.

MATERIAL. IN.43490, carapace, figured Jones (1884), Richmond boring, 1,205 ft.

REMARKS. The specimen described by Jones (1884 : 768) from 1,151 ft.-1,151 ft. 6 in. in the Richmond boring is not conspecific with that described from 1,205 ft. The latter is a Cretaceous contaminant.

DIMENSIONS. IN.43490, carapace, length 0.95 mm.; height 0.60 mm.; width 0.43 mm.

Schuleridea (Eoschuleridea) subperforata (Jones)

(Pl. 2, fig. 4)

1884 *Cythereidea subperforata* Jones : 768, pl. 34, fig. 25, [not p. 772, pl. 34, fig. 26].

LECTOTYPE. IN.43504, right valve, figured Jones 1884, pl. 34, fig. 25. Richmond boring, 1,151 ft.-1,151 ft. 6 in.

REMARKS. Male right valve elongate-oval in outline with a characteristic prominence in the region of the anterior cardinal angle. Antero-dorsal slope short, steeply inclined, and concave. Anterior and posterior ends rounded; ventral margin convex with a prominent antero-ventral incurvature. At least twenty-one anterior radial pore canals in typical fan-like arrangement. Hinge broken, terminal teeth incomplete. Duplicature well developed, particularly postero-ventrally. Poor preservation prevents further description.

In outline this species is similar to the male dimorph of *Schuleridea (Eoschuleridea) bathonica* Bate (1967 : 41) but may be distinguished by the antero-dorsal prominence in the region of the cardinal angle and being slightly more narrowly rounded posteriorly.

DIMENSIONS. IN.43504, right valve, length 0.73 mm.; height 0.39 mm.

Schuleridea (Eoschuleridea) trigonalis (Jones)

(Pl. 2, fig. 7)

1884 *Bairdia trigonalis* Jones : 767, pl. 34, fig. 19.

DIAGNOSIS. Carapace trigonal in outline with high dorsal margin: Dorsum short, slightly convex, posteriorly sloping in right valve; umbonate left valve which prominently overreaches the right. Greatest length of carapace below mid-point. Greatest height anterior of mid-point in right valve, through mid-point in left. Anterior end rounded, posterior strongly acuminate. Antero- and postero-dorsal slopes steeply inclined. Anterior radial pore canals few in number.

HOLOTYPE. IN.42373, carapace figured Jones 1884, pl. 34, fig. 19; Richmond boring, depth 1,151 ft.-1,151 ft. 6 in.

DESCRIPTION. Carapace strongly trigonal in lateral view with the umbonate left valve projecting noticeably above the right. Posterior end strongly acuminate, anterior end rounded. Greatest length of carapace below mid-point; greatest height of the left valve through mid-point and of the right valve slightly forward of this. Greatest width median. Ventral margin broadly convex; dorsal margin in the right valve short and slightly convex, sloping to the posterior. Dorsal margin in the left valve strongly umbonate. Antero-dorsal and postero-dorsal slopes steeply inclined, slightly convex. Shell surface very finely punctate. Left valve larger than the right which it overlaps along the ventral margin, around the posterior and along the

antero-dorsal and postero-dorsal slopes. Mid-dorsally the left valve projects strongly above the right. Internal details not seen. Anterior radial pore canals not clearly seen but appear to be relatively few.

DIMENSIONS. IN.42373, carapace, length 0.70 mm.; height 0.48 mm.; width 0.36 mm.

REMARKS. If the species is dimorphic, the holotype must be that of a female carapace. A species close to this is *Schuleridea (Eoschuleridea) bathonica* Bate (1967 : 41) from which it may be distinguished by the strongly umbonate left valve and the more strongly acuminate posterior.

Genus *PRAESCHULERIDEA* Bate 1963

Praeschuleridea schwageriana (Jones)

(Pl. 2, fig. 6)

1884 *Cythere schwageriana* Jones : 766, pl. 34, fig. 27.

DIAGNOSIS. Carapace oval in outline with the left valve projecting above the right. Postero-dorsal slope of left valve rounded, posterior rounded. Shell surface finely punctate.

HOLOTYPE. IN.43499, female carapace, figured Jones 1884, pl. 34, fig. 27. From depth 1,145 ft. 9 in.—1,146 ft. 6 in.

DESCRIPTION. Carapace oval in outline with rounded anterior and posterior margins. Ventral margin broadly, but not strongly convex in left valve, somewhat flattened in the right valve. Dorsal margin strongly convex in the left valve, projecting above the right. Anterior cardinal angle rounded, posterior angle more sharply acute. Postero-dorsal slope steeply inclined, more strongly convex in the left valve. Antero-dorsal slope convex in both valves. Greatest length through mid-point. Greatest height median; greatest width slightly behind mid-point. Shell surface finely punctate. Left valve larger than the right. No internal features observed.

DIMENSIONS. IN.43499, female carapace, length 0.60 mm.; height 0.39 mm.; width 0.31 mm.

REMARKS. Jones (1884) referred to but a single specimen for this species and illustrated a left valve. However, in the plate description he referred to fig. 27 as a right valve. The actual specimen is in fact a complete carapace, and in the absence of any evidence to the contrary is considered here to be the holotype.

Praeschuleridea schwageriana is similar to *P. subtrigona* (Jones & Sherborn 1888) but is larger and less angular posteriorly: it is close to *P. subtrigona intermedia* Bate (1965) but may be distinguished by the more uniformly rounded posterior end. Given more material showing only slight variation in outline, it might not be possible to distinguish *P. schwageriana* from one of the subspecies of *P. subtrigona*.

Praeschuleridea sp.

(Pl. 2, fig. 8)

DESCRIPTION. Carapace trigonal in outline with the left valve strongly umbonate and projecting above the right valve. Strongly convex when viewed dorsally. Greatest length, height (left valve) and width pass through mid-point. Right valve somewhat umbonate in the region of the anterior cardinal angle, below which there is a deep, oblique groove. Left valve larger than the right. Anterior and posterior margins rounded; ventral margin broadly convex. Internal details not seen. Anterior radial pore canals in part seen from the exterior and appear typical for the genus.

DIMENSIONS. Io.3619, female carapace, length 0.59 mm.; height 0.43 mm.; width 0.35 mm.

REMARKS. This somewhat globose, triangular ostracod is similar in general outline to *Schuleridea trigonalis* (Jones 1884), but differs most markedly in that the line of greatest length passes through mid-point and not below it as in the latter species.

This species of *Praeschuleridea* is almost certainly new and was found in a slide of duplicate material obtained from the Richmond boring; depth 1,151 ft. 6 in. It is considered inadvisable to erect a new species on only a single specimen.

Family **PROGONOCYTHERIDAE** Sylvester-Bradley 1948

Subfamily **PROGONOCYTHERINAE** Sylvester-Bradley 1948

Genus **GLYPTOCYTHERE** Brand & Malz 1962

Glyptocythere guembeliana (Jones)

(Pl. 3, figs. 1, 2; Pl. 4, fig. 1)

1884 *Cythere guembeliana* Jones : 772, pl. 34, figs. 32, 33, [not fig. 31].

1888 *Cytheridea pulvinar* Jones & Sherborn : 266, pl. 3, figs. 2a-c.

1888 *Cytheridea trapezoidalis* Terquem, Jones & Sherborn : 270, pl. 4, figs. 1a, b.

1967 *Glyptocythere guembeliana* (Jones) Bate : 49, pl. 13, figs. 10-16, pl. 14, figs. 1-8.

DIAGNOSIS. Carapace subquadrate, elongate in male dimorph. Lateral surface with transverse ridges extending down from dorsal margin, though generally poorly developed. Marginal borders compressed. Ventro-lateral margin evenly convex in female, sharply directed upwards posteriorly in male right valve. Hinge weakly entomodont.

LECTOTYPE. IN.43493, male right valve from Richmond boring, depth 1,205 ft. Figured Jones (1884, pl. 34, fig. 33).

PARALECTOTYPE. Io.3338, male carapace from same depth.

REMARKS. This species was revised by Bate (1967 : 49). The specimen illustrated is the lectotype (IN.43493) figured by Jones 1884, pl. 34, fig. 33, and recorded from a depth of 1,205 ft. The specimen for fig. 32 is missing and that of fig. 31 is not considered conspecific.

DIMENSIONS. Lectotype: IN.43493, male right valve, length 0.96 mm.; height 0.49 mm.

Genus *FASTIGATOCY THERE* Wienholz 1967

Fastigatocythere juglandica (Jones)

(Pl. 3, figs. 4, 7, 8; Pl. 12, fig. 3)

- 1884 *Cythere juglandica* Jones : 766, 768, pl. 34, figs. 36, 37.
 1888 *Cythere juglandica* var. major Jones & Sherborn : 225, pl. 4, figs. 2a-b.
 1948 *Progonocythere juglandica* (Jones) Sylvester-Bradley : 193, pl. 12, figs. 5, 6, pl. 13, fig. 8.
 1963 *Progonocythere juglandica juglandica* (Jones); Grekoff : 1731, pl. 3, fig. 55.
 1963 *Progonocythere?* *juglandica* (Jones); Oertli : pls. 28, 29, 30.
 1967 *Glyptocythere juglandica* (Jones) Bate : 51.

DIAGNOSIS. Carapace sub-rectangular tapering strongly to posterior end. Left valve larger than right, projecting above right valve dorsally, except mid-dorsally where the umbonate right valve strongly projects. Ornamentation of transverse ridges and reticulae radiate down from dorsal margin. Ventro-lateral margins convex; carapace swollen medially. Flattened marginal borders. Hinge entomodont.

LECTOTYPE. IN.41947, right valve. Richmond boring, 1,146 ft. Figured Jones (1884).

PARALECTOTYPES. IN.41948-9. Two carapaces from 1,151 ft. 6 in.

REMARKS. This species was described by Sylvester-Bradley (1948) who placed it in his new genus *Progonocythere*. Brand & Malz (1962) removed from that genus those species which have a more quadrate outline, which possess a distinct ornamentation not usually present in species of *Progonocythere* s.s., and which also have a dorsal projection of the dorso-median part of the right valve. The last feature was noted by Sylvester-Bradley (1948 : 194) and used by Bate (1967 : 51) to justify the assignment of this species to *Glyptocythere*. Subsequently Wienholz (1967 : 25) separated from *Glyptocythere* those species which have a more elongate carapace outline, a more positive antero-dorsal furrow and strongly diverging ribs radiating from the dorsal margin. For these species Wienholz erected the genus *Fastigatocythere*, to which she assigned *juglandica*. This assignment is accepted here.

DIMENSIONS. Lectotype: IN.41947, right valve, length 0.93 mm.; height 0.47 mm. IN.41948, carapace, length 0.87 mm.; height 0.51 mm.; width 0.49 mm. IN.41949, carapace, length 0.77 mm.; height 0.49 mm.; width 0.49 mm.

Genus *LOPHOCY THERE* Sylvester-Bradley 1948

REMARKS. There is an understandable reluctance on the part of some ostracod workers to identify a genus or subgenus simply on an ornamental variation. However, some ostracod lineages fall naturally into morphological groups in which a particular ornamental trend is evident. I feel that within the Ostracoda there is ornamentation

of a primary kind which reflects a generic or possibly subgeneric status, and a secondary ornamentation of a more specific character. The latter might be superimposed upon the former or simply modify it.

Lophocythere clearly contains two distinct morphological groups: the first centred around *Lophocythere ostreata* (Jones & Sherborn 1888) with an L-shaped ridge extending around the anterior margin and bending back along the ventro-lateral margin as the diagnostic character, and the second around *L. bradiana* (Jones 1884), in which several ridges extend across the lateral surface of the carapace.

Whatley (personal communication) informs me that he has, in manuscript, subdivided the genus *Lophocythere* accordingly. As this information will shortly be published by him it is not my intention to deal further with this generic revision.

Lophocythere bradiana (Jones)

(Pl. 3, figs. 3, 5, 6; Text-figs. 3, 4)

1884 *Cythere bradiana* Jones : 772, pl. 34, figs. 38a-b.

1888 *Cytheridea craticula* Jones & Sherborn : 272, pl. 4, figs. 9a-c, 10a-c.

1948 *Lophocythere bradiana* (Jones) Sylvester-Bradley : 196, pl. 14, figs. 7-10, pl. 15, figs. 8-11.

DIAGNOSIS. Carapace subrectangular, dimorphic. Left valve larger than, and projects dorsally above, the right. Anterior end broadly rounded, posterior end triangular with greatest length of carapace through mid-point. Cardinal angles prominent, rounded. Eye swelling situated at anterior cardinal angle. Lateral surface ornamented by four major carinae: dorsal carina originates at, or a short distance from, the anterior margin, curves under the eye swelling, to which a short offshoot runs, then curves back over dorso-median part of valve to die out below posterior cardinal angle. The second carina originates at the antero-ventral margin, runs parallel to the dorsal carina for a short distance then bifurcates, the two branches running parallel almost to the posterior end where they converge and almost meet. The fourth carina originates at the antero-ventral margin then follows a course roughly parallel to lowermost of the two median carinae. A short carina occurs between the ventral carina and the lowest median carina in the anterior half of the valve. A second short carina, convex dorsally, occurs between the dorsal carina and the uppermost of the two median carinae in the posterior half of the valve, in which region a short, straight carina, is sometimes developed between the two median carinae. Shell surface reticulate between the carinae.

LECTOTYPE. IN.42372, male carapace, figured Jones (1884), Richmond boring, depth 1,205 ft.

PARALECTOTYPES. Io.3627-9, one male and two female carapaces from depth 1,205 ft.

DESCRIPTION. Carapace subrectangular, more elongate in the male dimorphs. Dorsal and ventral margins virtually parallel, with rounded anterior, and triangular posterior margins. Cardinal angles prominent, rounded, especially prominent in the larger left valve, the dorsal margin of which projects above the right. Ventral

surface ornamented with three longitudinal ridges per valve. Left valve uniformly overlaps the right along the ventral margin, more strongly so antero-ventrally. Greatest length of carapace through mid-point, greatest height in the anterior third, greatest width in the posterior third. Ornamentation of lateral surface as in the diagnosis. **Eye swelling** prominently situated below the anterior cardinal angle. Details of hinge not known from the type material although it is entomodont in comparative material.

DIMENSIONS. IN.42372, male carapace, length 0.61 mm.; height 0.32 mm.; width 0.29 mm. Io.3627, male carapace, length 0.65 mm.; height 0.34 mm.; width 0.30 mm. Io.3628, female carapace, length 0.57 mm. height 0.34 mm.; width 0.29 mm. Io.3629, female carapace, length 0.66 mm.; height 0.39 mm.; width 0.34 mm.

REMARKS. Sylvester-Bradley (1948) placed *Cytheridea bradiana* Jones & Sherborn in synonymy with *Cythere bradiana* Jones. However, the specimen described by Jones & Sherborn is not conspecific but is a paralectotype of *Lophocythere septicostata* Bate (1967 : 52, pl. 15, figs. 7-13, pl. 16, figs. 1-4).

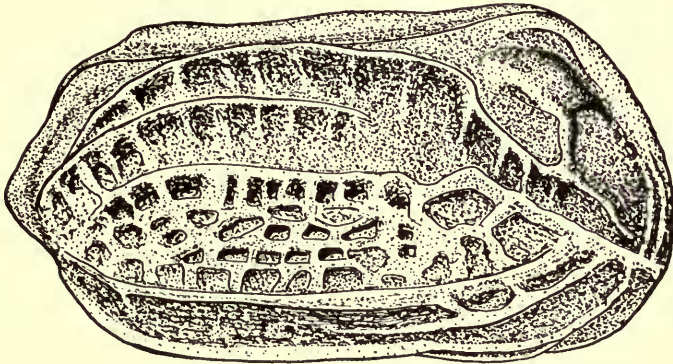


FIG. 3. *Lophocythere bradiana* (Jones). Right valve, complete carapace of lectotype of *Cytheridea bradiana* Jones. IN.42372. $\times 140$.

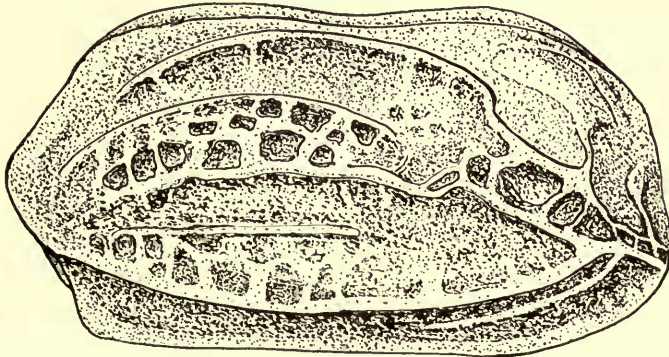


FIG. 4. *Lophocythere bradiana* (Jones). Right valve, complete carapace of lectotype of *Cytheridea craticula* Jones & Sherborn. I.1854. $\times 140$.

Sylvester-Bradley (1948 : 197) considered *Cytheridea craticula* Jones & Sherborn 1888 to be a subspecies of *bradiana* because "there is a short anterior stem from which spring the dorsal, the two median, and the ventral carinae". Examination of the types of *bradiana* and of *craticula* show this is not, in fact so. The dorsal carina does not in all specimens reach the anterior margin. Where the reticulate ornamentation is particularly well developed a cross reticulation gives the impression that the dorsal carina is joined to the median carina. The ventral carina originates at the antero-ventral margin, and it is the short carina situated between this and the lowermost median carina which sometimes joins the stem of the two median carinae.

Although the lectotype of *L. bradiana* shows the development of a low ridge or carina between the two median carinae in the posterior part of the valve, many specimens do not show this feature. It is, however, well developed in the male paralectotype, Io.3627, and should not be regarded as being a feature of *craticula* even though the lectotype of the latter shows it remarkably well.

To summarize, the variations found within a population of *Lophocythere bradiana*, such as the occasional imperfect development of the dorsal carina close to the anterior margin and the presence or absence of a short carina posteriorly between the two median carinae, do not indicate either a separate species or subspecies, but are part of the normal variation present in the species.

L. bradiana is followed in the Oxfordian of France by *L. multicosata* Oertli (1957), a species which has a similar ornamentation. However, *L. multicosata* does not possess the anterior carina situated between the ventral and lower median carina of *bradiana*, but has an additional anterior ridge in front of the eye swelling.

The variations within *Lophocythere bradiana* are illustrated in Text-figs. 3, 4.

Genus *MICROPNEUMATOCY THERE* Bate 1963

Micropneumatocythere subconcentrica (Jones)

(Pl. 4, fig. 7)

1884 *Cythere subconcentrica* Jones : 768, pl. 34, figs. 28, 29.

1967 *Micropneumatocythere subconcentrica* (Jones) Bate : 60, pl. 21, figs. 1-13.

DIAGNOSIS. *Micropneumatocythere* with oval carapace tapering posteriorly. Vento-lateral margin swollen. Shell surface punctate laterally. Ventral surface with longitudinal ridges extending on to ventro-lateral margin and turning upwards anteriorly and posteriorly. Internal details as for genus.

LECTOTYPE. IN.43505, left valve from Richmond boring, depth 1,151 ft. 6 in. Figured Jones (1884, pl. 34, fig. 28).

REMARKS. This species has been revised by Bate (1967 : 60) and need not be dealt with fully here. The lectotype, a left valve, is considered to be the specimen figured by Jones although the caption to the figure states that it is a right valve.

DIMENSIONS. IN.43505, left valve, length 0.56 mm.; height 0.38 mm.

Genus *TERQUEMULA* Blaszyk & Malz 1965

Terquemula blakeana (Jones)

(Pl. 4, fig. 8; Pl. 5, fig. 1)

- 1884 *Cythere blakeana* Jones : 772, pl. 34, figs. 34, 35.
 1888 *Cytheridea transversiplicata* Jones & Sherborn : 267, pl. 3, fig. 4.
 ?1888 *Cytheridea blakeana* (Jones), Jones & Sherborn : 265, pl. 2, fig. 11.
 1888 *Cytheridea egregia* Jones & Sherborn : 267, pl. 3, fig. 5.
 1948 *Progonocythere blakeana* (Jones), Sylvester-Bradley : 191, pl. 12, figs. 3, 4, pl. 13, figs. 4, 5.
 1959 *Progonocythere ? blakeana* (Jones), Triebel & Klingler : 339, 341.
 1963 *Progonocythere ? blakeana* (Jones), Oertli : 36, pl. 25, fig. c, pl. 26, fig. c, pl. 27, fig. c, pl. 28, fig. c, pl. 30, fig. c.
 1965 *Terquemula blakeana* (Jones), Blaszyk & Malz : 445.

DIAGNOSIS. Carapace oval-elongate, noticeably constricted mid-dorsally and mid-ventrally. Anterior end rounded, posterior end narrowly rounded. Posterolateral part of carapace swollen, overreaching ventral margin. Greatest length through or slightly above mid-point. Shell surface with large, sunken normal pore canal openings and a broad reticulation of wrinkles. Muscle scars of Type A (Bate 1963 : 180). Species dimorphic. Hinge entomodont.

LECTOTYPE. IN.41950, female left valve, Richmond boring, depth 1,205 ft. Figured Jones (1884).

REMARKS. This species was described fully by Sylvester-Bradley (1948). The type specimen of *Cytheridea egregia* Jones & Sherborn, placed by Sylvester-Bradley in synonymy with *blakeana*, has been lost, but the original illustration (pl. 3, fig. 5) suggests that the synonymy is justified.

The specimen described as *C. blakeana* by Jones & Sherborn could be a juvenile form of another specimen as suggested by Sylvester-Bradley (1948 : 193).

DIMENSIONS. Lectotype: female left valve, length 0.69 mm.; height 0.39 mm.

Family CYTHERURIDAE Müller 1894

Genus *METACYTHEROPTERON* Oertli 1957

Metacytheropteron drupaceum (Jones)

(Pl. 5, figs. 4-6)

- 1884 *Cythere drupacea* Jones : 772, pl. 34, fig. 30.
 1957a *Metacytheropteron* sp. 50, Oertli : table 1.
 1963 *Cytheropteron jonesanum* Coryell : 854.
 1967 *Metacytheropteron drupacea* (Jones); Bate : 44, pl. 10, figs. 1-9.

DIAGNOSIS. *Metacytheropteron* with elongate/sub-ovate carapace. Greatest height at anterior cardinal angle, posterior end acuminate. Dorsal margin broadly convex, especially in left valve. Shell surface strongly ornamented with triangular arrangement of longitudinal and obliquely transverse ridges.

HOLOTYPE. IN.43498, female carapace from Richmond boring, depth 1,205 ft. Figured Jones (1884).

REMARKS. Coryell (1963) renamed this species *Cytheropteron jonesanum* on the assumption that *C. drupacea* mentioned by Richter (1867 : 228) and *Cythere drupacea* of Jones were homonyms. Reference to Richter (1855 : 529), however, indicates that the species referred to in 1867 had been placed in *Cythereis* and not *Cythere* as supposed by Coryell. There is, therefore, no nomenclatural problem.

DIMENSIONS. Holotype. IN.43498, carapace, length 0.50 mm.; height 0.30 mm.; width 0.29 mm.

Family **TRACHYLEBERIDIDAE** Sylvester-Bradley 1948

Genus **CYHEREIS** Jones 1849

Cythereis cf. *blanda* Kaye 1963

(Pl. 5, figs. 3, 7)

1884 *Cythere* (*Cythereis*) *quadrilatera* (Roemer), Jones : 766, 772, pl. 34, figs. 39, 40, 41.

REMARKS. Jones recorded *Cythereis quadrilatera* Roemer from two horizons in the Richmond boring (1,145 ft. 9 in.—1,146 ft. 6 in., and 1,205 ft.). These specimens are probably conspecific with *Cythereis blanda* Kaye (1963), although the median and ventro-lateral ridges in Jones's material tend to be more straight and less strongly developed than in *C. blanda*. But this may be within the species' variation.

Jones referred to three specimens, here regarded as Cretaceous contaminants, of *Cythere* (*Cythereis*) *quadrilatera* but only two now remain; these are a complete carapace, IN.43491, figured Jones 1884, pl. 34, fig. 40, and a single left valve IN.43502, figured pl. 34, fig. 39. The specimen illustrated by fig. 41 is missing and the illustration suggests that this latter specimen was not conspecific with the other two.

DIMENSIONS. IN.43491, carapace, length 0.77 mm.; height 0.46 mm.; width 0.32 mm. IN.43502, left valve, length 0.66 mm.; height 0.43 mm.

Family and Genus uncertain

“*Cythere*” *tenella* Jones

(Pl. 5, fig. 8)

1884 *Cythere tenella* Jones : 772, pl. 34, fig. 24.

REMARKS. This small, poorly-preserved ostracod is probably a juvenile instar.

HOLOTYPE. IN.43492, complete carapace, Richmond boring, depth 1,205 ft.

DIMENSIONS. Length 0.38 mm.; height 0.21 mm.; width 0.15 mm.

III. THE T. R. JONES & C. D. SHERBORN COLLECTION
AND THE H. H. WINWOOD COLLECTION

The following figured specimens of species described by Jones & Sherborn (1888) are no longer represented in their collection and may be presumed lost. Only the first five are known to have been presented to the Museum.

Bairdia juddiana Jones, p. 253.

Cytheridea bicarinata Jones & Sherborn, p. 270, pl. 4, figs. 5a-c.

Cytheridea renoides Jones & Sherborn, p. 266, pl. 3, figs. 1a-c.

Cytheridea winwoodiana Jones & Sherborn, p. 259, pl. 1, figs. 2a-d.

Cytheridea eximia Jones & Sherborn, p. 273, pl. 5, figs. 5a-c.

Bairdia trigonalis Jones, p. 253.

Bythocypris winwoodiana Jones & Sherborn, p. 252, pl. 5, figs. 1a-c.

Cythere juglandica var. *minor* Jones & Sherborn, p. 255, pl. 4, figs. 3a-c.

Cythere ? *speciosa* Jones & Sherborn, p. 254, pl. 2, figs. 10a-c. (This species was recorded as lost by Jones & Sherborn, p. 254.)

Cythere trapezioides Jones & Sherborn, p. 256, pl. 5, figs. 10a-c.

Cythere walfordiana Jones & Sherborn, p. 255, pl. 5, figs. 9a-c.

Cytheridea egregia Jones & Sherborn, p. 267, pl. 3, figs. 5a-c.

Cytheridea politula Jones & Sherborn, p. 265, pl. 5, figs. 7a-c.

Cytheridea pura Jones & Sherborn, p. 269, pl. 3, figs. 11a-d.

Cytheridea retorrída Jones & Sherborn, p. 260, pl. 1, figs. 8a-c.

Cytheridea rugifera Jones & Sherborn, p. 271, pl. 5, figs. 11a-c.

Cytheridea sedata Jones & Sherborn, p. 261, p. 1, figs. 10a-c.

Cytheridea subeminula Jones & Sherborn, p. 261, pl. 5, figs. 8a-c.

Cytheridea ventrosa Jones & Sherborn, p. 269, pl. 3, figs. 10a-c.

Cythereis walfordiana Jones & Sherborn, p. 257, pl. 5, figs. 12a-c.

Order PODOCOPIDA Müller 1894

Suborder PLATYCOPINA Sars 1866

Family CYTHERELLIDAE Sars 1866

Genus CYTHERELLA Jones 1849

Cytherella fullonica Jones & Sherborn

(Pl. 5, fig. 9; Pl. 6, fig. 1)

1888 *Cytherella fullonica* Jones & Sherborn : 274, pl. 1, figs. 12a-c.

1963 *Cytherella fullonica* Jones & Sherborn; Bate : 184, pl. 1, figs. 1, 2.

DIAGNOSIS. Carapace subrectangular with characteristically steep postero-dorsal slope. Shell surface smooth, with dorso-median muscle-scar depression.

LECTOTYPE. I.1857, left valve, figured Jones & Sherborn 1888, from the Blue Fuller's Earth Clay.

PARALECTOTYPES. I.4004 (Jones & Sherborn Collection); Io.3636-41 (Winwood Collection), left and right valves. Three specimens from the Blue, and four from the Yellow Fuller's Earth Clay.

REMARKS. This species has been previously described in Bate (1963 : 184).

DIMENSIONS. Lectotype: I.1857, left valve, length 0.64 mm.; height 0.34 mm. Paralectotype Io. 4004, left valve, length 0.58 mm.; height 0.32 mm.

Genus *CYTHERELLOIDEA* Alexander 1929

Cytherelloidea catenulata (Jones & Sherborn)

(Pl. 6, figs. 2, 3)

- 1888 *Cytherella catenulata* Jones & Sherborn : 274, pl. 5, figs. 6a-c.
 1948 ? *Cytherelloidea catenulata* (Jones & Sherborn) Sylvester-Bradley : 200, pl. 14, fig. 11.
 1963 *Cytherelloidea catenulata* (Jones & Sherborn); Bate : 184, pl. 1, figs. 3-6.
 1963 *Cytherelloidea catenulata* (Jones & Sherborn); Oertli : 37, pls. 27, 29.
 1964 *Cytherelloidea catenulata* (Jones & Sherborn); Bate : 8.

DIAGNOSIS. Carapace with crescent-shaped swelling situated close to posterior margin of valve. Dorsal limb of crescent bends over and curves forwards close to ventral margin to produce a swelling shaped like a question mark. Shell surface ornamented with longitudinal and terminal (parallel to margins) striae producing a reticulation.

LECTOTYPE. I.1876, left valve, figured Jones & Sherborn, from the Blue Fuller's Earth Clay.

PARALECTOTYPES. I.1846 (left valve) and Io.3525 (right valve), Jones & Sherborn Collection; Io.3649-53, left and right valves from the Winwood Collection. All specimens from the Blue Fuller's Earth Clay.

REMARKS. This species was described by Bate (1963 : 184-5).

DIMENSIONS. I.1876, left valve, length 0.68 mm.; height 0.37 mm. I.1846, left valve; length 0.68 mm.; height 0.36 mm. Io.3525, right valve, length 0.68 mm.; height 0.38 mm.

Cytherelloidea refecta (Jones & Sherborn)

(Pl. 6, figs. 4-7)

- 1888 *Cytheridea refecta* Jones & Sherborn : 262, pl. 2, figs. 3a, b.

DIAGNOSIS. Carapace oval, more elongate in male dimorph. Anterior and posterior margins rounded. Posterior cardinal angle prominent, postero-dorsal slope slopes steeply to posterior. Central part of valve with broad depression bounded below by broad crescentic swelling. Crescentic furrow delimits lower surface of swelling. A small rounded swelling is situated to the inside of the anterior part of crescentic swelling.

LECTOTYPE. I.1850, female right valve, figured Jones & Sherborn (1888), from the Blue Fuller's Earth Clay.

PARALECTOTYPES. Io.3931-2, female left valve and male left valve from the Winwood Collection. Both specimens from the Blue Fuller's Earth Clay.

DESCRIPTION. Carapace oval in outline with rounded anterior and posterior margins and prominent posterior cardinal angle. The postero-dorsal slope is steeply inclined, but slightly convex. Dorsal margin of both valves slightly concave antero-

medially. Ventral margin convex in the right valve, concave in the left. Shell surface with a broad, deep furrow, crescentic in shape which commences postero-dorsally and terminates antero-dorsally. Above this furrow a broad swelling is developed, also crescentic but rather irregular in outline. Anteriorly the swelling appears to turn back sharply upon itself for a short distance before dying out. To the inside of this swelling and situated in the angle of the anterior turn-back, a small circular swelling is developed. The main crescentic swelling is delimited on its dorsal side by a broad central depression. In the region of the anterior margin the surface of the shell may be seen to be weakly reticulate. Internally the dorsal edge of the right valve possesses a groove for the reception of the valve margin of the smaller left valve.

DIMENSIONS. I.1850, female right valve, length 0.60 mm.; height 0.26 mm. Io.3931, female left valve, length 0.52 mm.; height 0.28 mm. Io.3932, male left valve, length 0.71 mm.; height 0.38 mm.

REMARKS. *Cytherelloidea resecta* has a distinctive ornamentation which separates it from other Jurassic species of the genus. Within the Jurassic the predominant ornamentation of the cytherelloideas consists of either a peripheral ridge or swelling and/or a central ridge or swelling. The development of strong lateral ridges extending from the posterior region, though present in some Jurassic species (Field 1966), is predominantly a feature of Cretaceous and Tertiary species.

Suborder PODOCOPINA Sars 1866

Superfamily **BAIRDIACEA** Sars 1888

Family **BAIRDIIDAE** Sars 1888

Genus **BAIRDIA** McCoy 1844

Bairdia hilda Jones

(Pl. 4, fig. 5)

1884 *Bairdia hilda* Jones : 771, pl. 34, fig. 20.

1888 *Bairdia fullonica* Jones & Sherborn : 253, pl. 5, figs. 4a-c.

For complete synonymy see p. 383.

REMARKS. Sylvester-Bradley (1948 : 199) first pointed out that the variation found within specimens of *Bairdia hilda* and *Bairdia fullonica* was such that there was as yet no evidence for regarding these species as distinct. Accordingly they were placed in synonymy. The lectotype of *B. fullonica* (I.1873, a right valve from the Blue Fuller's Earth Clay, figured Jones & Sherborn) was in the Jones & Sherborn Collection, whilst the paralectotype, also a right valve (Io.3554) and from the Blue Fuller's Earth Clay, was in the Winwood Collection.

DIMENSIONS. I.1873, right valve, length 0.79 mm.; height 0.42 mm. Io.3554, right valve, length 0.76 mm.; height 0.39 mm.

In addition to the types there are four right valves and one left valve (I.1848 from the Jones & Sherborn Collection and Io.3911-2 and Io.271 from the Winwood Collection) from the Blue Fuller's Earth Clay and referred to by Jones & Sherborn on p. 253.

Bairdia sherborni sp. nov.

(Pl. 6, fig. 8; Pl. 7, fig. 1)

DIAGNOSIS. Carapace sub-rectangular in outline. Dorsal margin very slightly convex, sloping slightly to posterior. Ventral margin strongly incurved medially. Anterior end obliquely rounded. Posterior end narrowly rounded, somewhat tapering, but not upturned. Left valve larger than the right. Muscle scars as for the genus. Shell surface strongly and coarsely pitted.

HOLOTYPE. Io.3913, complete carapace from the Yellow Fuller's Earth Clay, Winwood Collection.

PARATYPE. Io.3557, complete carapace from the Fuller's Earth Clay, Möckler Collection.

DESCRIPTION. Carapace sub-rectangular, elongate bairdioid in outline, the dorsal margin very slightly convex but almost straight, sloping gently to the posterior. The ventral margin is typical of the genus, being strongly incurved medially. Anteriorly the margin is obliquely rounded, sharply cut just above a line running through mid-point (line of greatest length) by the inclined antero-dorsal slope. Postero-dorsal slope slightly concave, postero-ventral slope convex. Posterior end tends to be tapered without the strong upturning of most bairdias. Greatest height of carapace through the anterior cardinal angle; greatest width in the posterior third. Shell surface distinctly and evenly pitted. Left valve larger than the right which it overlaps mid-ventrally though not antero-ventrally and postero-ventrally. Antero-dorsally and postero-dorsally the gape is replaced by a prominent overlap of the right valve by the left. Internal details not observed apart from the **muscle scars** which may be observed as impressions on the internal cast of the holotype. They comprise seven adductor scars arranged in a circle with an eighth situated at the centre and a ninth, probably also an adductor scar, situated dorsally to this group. An additional dorsal scar is placed above that last mentioned whilst antero-ventrally there are two oval "mandibular" scars and antero-dorsally a single "antennal" scar.

DIMENSIONS. Io.3913, carapace, length 0.58 mm.; height 0.31 mm.; width 0.21 mm. Io.3557, carapace, length 0.71 mm.; height 0.39 mm.; width 0.27 mm.

REMARKS. Only two specimens have been found, one in each of two major collections. The outline of the carapace; obvious antero-ventral and postero-ventral gape and distinct surface pitting distinguish this species easily from all other Jurassic bairdiids.

Superfamily **CYPRIDACEA** Baird 1845

Family **PARACYPRIDIDAE** Sars 1923

Genus **PARACYPRIS** Sars 1866

Paracypris terraefullonicae (Jones & Sherborn)

(Pl. 7, figs. 2, 4)

1888 *Macrocypris terrae-fullonicae* Jones & Sherborn : 252, pl. 5, figs. 3a-c.

1888 *Macrocypris horatiana* Jones & Sherborn : 252, pl. 5, figs. 2a-c.

1967 *Paracypris terraefullonica* (Jones & Sherborn) Bate : 27, pl. 1, figs. 1-6.

DIAGNOSIS. Carapace elongate, posteriorly acuminate. Anterior end rounded. Ventral margin almost straight in the larger left valve, more strongly concave in the right. Dorsal margin arched with antero-dorsal slope tending to be slightly concave, more noticeably so in the right valve. Shell surface smooth. Anterior and posterior vestibules well-developed. Radial pore canals branching.

LECTOTYPE. I.1875, left valve, figured Jones & Sherborn 1888, pl. 5, figs. 3a-c, from the Blue Fuller's Earth Clay.

OTHER MATERIAL. I.1874, right valve (lectotype of *Macrocypris horatiana* Jones & Sherborn), figured Jones & Sherborn 1888, pl. 5, figs. 2a-c, and Io.3548-53 (paralectotypes of *M. horatiana* and *M. terraefullonicae*), from the Blue Fuller's Earth Clay.

REMARKS. *Paracypris terraefullonicae* has been fully described in Bate (1967 : 27). The additional specimens listed above (Io.3548-53) were found in the Winwood Collection and are paralectotypes of *Macrocypris horatiana* and *Macrocypris terraefullonicae* which "species" are the right and left valves respectively of *Paracypris terraefullonicae*.

DIMENSIONS. I.1875, left valve, length 0.60 mm.; height 0.28 mm. I.1874, right valve, length 0.58 mm.; height 0.26 mm.

Superfamily **CYTHERACEA** Baird 1850

Family **BYTHOCYTHERIDAE** Sars 1926

Genus **MONOCERATINA** Roth 1928

Monoceratina visceralis (Jones & Sherborn)

(Pl. 7, fig. 3)

1888 *Cytheridea visceralis* Jones & Sherborn : 268, pl. 3, figs. 6a-c.

DIAGNOSIS. Carapace sub-rectangular in outline with rounded anterior end; the antero-dorsal margin tends to curve obliquely backwards. Posterior end triangular with greatest prolongation situated in dorsal half of valve. Dorsal and ventral margins parallel. A distinct median sulcus present in dorsal half of valve only.

Valve convex, prominently swollen in postero-ventral region. Shell surface strongly pitted. Postero-ventral margin slightly serrated. Hinge with strong, straight, median bar.

HOLOTYPE. I.1830, left valve, figured Jones & Sherborn 1888, from the Blue Fuller's Earth Clay.

DESCRIPTION. The carapace is sub-rectangular in outline with a triangular posterior end, the ventral margin of which is longer than the straight postero-dorsal margin, and is evenly serrated along its length. At the postero-ventral angle there is a distinct convexity of the margin. Anterior cardinal angle prominently rounded. Dorsal and ventral margins parallel. A distinct vertical median sulcus is present in the dorsal half of the valve only. Carapace strongly swollen along the ventro-lateral border and postero-ventrally where the swelling is strongly undercut. Shell surface coarsely pitted, the pits extending uniformly over the valve. Line of greatest length lies above mid-point, whilst the line of greatest height passes approximately through the centre of the valve. Internally the hinge has been damaged, only the posterior part of the strong hinge bar being present. No other internal details observed.

DIMENSIONS. I.1830, left valve, length 0.66 mm.; height 0.30 mm.

REMARKS. Only the holotype is known, but it is distinct from the other species of *Monoceratina* described from the Jurassic. *M. visceralis* is close to *M. vulsa* (Jones & Sherborn), although the latter has a much coarser ornamentation, almost reticulate, whilst the median sulcus is much more strongly developed, as is the under-cutting of the ventro-lateral and postero-ventral swelling. *M. vulsa* is also distinguished by possessing a distinct furrow paralleling the anterior margin. *M. unguina* Triebel & Bartenstein (1938, pl. 1, figs. 3, 4) may be distinguished on outline, the posterior extremity being situated higher up on the valve because of the shorter postero-dorsal slope. The anterior margin is also uniformly rounded with a flattened marginal border.

Monoceratina vulsa (Jones & Sherborn)

(Pl. 7, fig. 5)

- 1888 *Cytheridea vulsa* Jones & Sherborn : 263, pl. 2, figs. 4a, b.
 1938 *Monoceratina vulsa* (Jones & Sherborn) Triebel & Bartenstein : 516, pl. 3, figs. 17, 18.
 1960 *Monoceratina* cf. *vulsa* (Jones & Sherborn); Lutze : 433, pl. 37, figs. 5a, b.
 ?1963 *Monoceratina* sp. juv. aff. *vulsa* (Jones & Sherborn); Plumhoff : 48, pl. 11, figs. 167, 168.
 1963 *Monoceratina vulsa* (Jones & Sherborn); Bate : 189, pl. 3, figs. 5-12.
 1963a *Monoceratina vulsa* (Jones & Sherborn); Bate : 26, pl. 1, fig. 6.
 1964 *Monoceratina vulsa* (Jones & Sherborn); Bate : 9.

DIAGNOSIS. Shell sub-rectangular in lateral view, convex in dorsal view. Vertical median sulcus deeply incised, surrounded below and to the sides by a prominent swelling which is strongly undercut ventro-laterally. Lateral swelling separated from anterior margin by a furrow which runs parallel to that margin. Shell surface strongly pitted, the raised borders of the pits giving the surface a wrinkled appearance.

LECTOTYPE. I.1842, a badly damaged left valve, figured Jones & Sherborn 1888, from the Blue Fuller's Earth Clay.

REMARKS. Only a single damaged valve remains of the two specimens originally placed in this species by Jones & Sherborn (p. 263), and this is the figured specimen. A complete description was given by Bate (1963) who incorrectly recorded the lectotype as coming from the Richmond boring.

DIMENSIONS. I.1842, length 0.64 mm.; height 0.32 mm. Both measurements would have been slightly larger if the specimen had not suffered slight damage posteriorly and along the dorsal margin.

Family **TRACHYLEBERIDIDAE** Sylvester-Bradley 1948

Subfamily **TRACHYLEBERIDINAE** Sylvester-Bradley 1948

Genus **OLIGOCYHEREIS** Sylvester-Bradley 1948

Oligocythereis fullonica (Jones & Sherborn)

(Pl. 7, fig. 6)

1888 *Cythereis fullonica* Jones & Sherborn : 256, pl. 4, figs. 13a-c.

1948 *Cythereis* cf. *fullonica* Jones & Sherborn; Sylvester-Bradley : 186, pl. 12, figs. 7, 8 [not figs. 9, 10], pl. 13, fig. 3 [not fig. 9].

1948a *Oligocythereis fullonica* (Jones & Sherborn) Sylvester-Bradley : 796.

1963 *Oligocythereis fullonica* (Jones & Sherborn); Oertli : 39, pl. 25, fig. a?, pl. 29, fig. a, [not pl. 24, fig. a, pl. 26, fig. a].

1967 *Oligocythereis fullonica* (Jones & Sherborn); Bate : 61, pl. 21, fig. 14, [not fig. 15].

DIAGNOSIS. Carapace subquadrate in outline with a broadly rounded anterior and broadly triangular posterior end. Anterior and posterior margins with small denticles. Ventral surface flattened, V-shaped in outline; ventral margin gently convex anteriorly and posteriorly. Dorsal margin almost straight, approximately paralleling ventral margin. Anterior cardinal angle extremely prominent with a large, rounded eye tubercle below. A short, thick ridge extends obliquely antero-ventrally from eye tubercle. Dorso-median ridge extends back from eye tubercle, enlarging posteriorly to give carapace triangular outline in dorsal view. Termination of dorso-median ridge produces a sharply pointed tubercle, angular in outline, the two sides of which are at right angles. Postero-ventrally a short, raised ridge almost vertically directed bends round at an oblique angle to extend forwards ventro-laterally bending upwards antero-ventrally to terminate in a prominent tubercle. This ventro-lateral ridge describes a broadly crescentic outline around a prominent, irregular tubercle. Prominent tubercle developed slightly anterior of mid-point. Shell surface very finely punctate. Left valve larger than right.

LECTOTYPE. I.1871, complete carapace, figured Jones & Sherborn 1888, from the Blue Fuller's Earth Clay.

DESCRIPTION. Carapace subquadrate in outline, ornamented as diagnosed. The angular outline of the shell is produced dorsally by the prominent antero-dorsal

eye tubercle and the strong postero-dorsal tubercle and ventrally by the postero-ventral and antero-ventral terminations of the ridge which extends along the ventro-lateral margin. The large tubercle situated slightly anterior of mid-point is the **muscle scar node** characteristic of the family. The anterior and posterior margins possess small denticles whilst the marginal borders bear a few additional nodes. Shell surface finely punctate. In dorsal view the outline of the carapace in the median part is V-shaped as is the ventral surface. This outline is produced by the dorso-median and ventro-lateral ridges diverging slightly towards the posterior end. Left valve larger than the right which it overlaps along the ventral margin and in the region of the cardinal angles and overreaches along the postero-dorsal slope. Internal details not observed in the type material, but the entomodont type **hinge** has been described by Sylvester-Bradley (1948 : 187).

DIMENSIONS. Lectotype, I.1871, carapace, length 0.54 mm.; height 0.32 mm.; width 0.27 mm.

REMARKS. Sylvester-Bradley (1948 : 187) noted variation within the ornamentation of specimens which he placed in *O. fullonica* (Jones & Sherborn), and it has been current practise to retain these within the species. The forms possessing a postero-dorsal tubercle from which three arms radiate (see Sylvester-Bradley 1948, pl. 12, figs. 9, 10) should be assigned to a new species. *O. fullonica* should be retained only for those specimens in which the postero-dorsal tubercle has two arms at right angles, and in which the muscle scar node to the centre of the valve is completely isolated and not joined to the anterior termination of the ventro-lateral ridge.

Family **SCHULERIDEIDAE** Mandelstam 1959
 Subfamily **SCHULERIDEINAE** Mandelstam 1959
 Genus **SCHULERIDEA** Swartz & Swain 1946
 Subgenus **EOSCHULERIDEA** Bate 1967
Schuleridea (*Eoschuleridea*) *horatiana* (Jones & Sherborn)
 (Pl. 7, fig. 7; Text-fig. 5)

1888 *Cytheridea horatiana* Jones & Sherborn : 263, pl. 2, figs. 5a, b.

DIAGNOSIS. Carapace oval/elongate, anteriorly rounded, posteriorly tapering, narrowly rounded. Greatest length of carapace below mid-point, greatest height at anterior cardinal angle. Elongate eye swelling with groove beneath present in right valve below anterior cardinal angle. Left valve projects slightly above right just behind anterior cardinal angle. Shell surface punctate with widely scattered, large, normal pore canals. Twenty-five to thirty radial pore canals splayed fan-like around anterior margin. Muscle scars type C. Hinge paleomerodont.

LECTOTYPE. I.1852, male right valve, figured Jones & Sherborn 1888, from the Blue Fuller's Earth Clay.

PARALECTOTYPE. Io.3940, male carapace from Blue Fuller's Earth Clay, Winwood Collection.

DESCRIPTION. Carapace oval/elongate in outline with uniformly rounded anterior margin and narrowly rounded, tapered posterior. The line of greatest length passes well below the mid-point. Greatest height at the anterior cardinal angle, greatest width just behind the mid-point. Dorsal margin convex, slightly umbonate in the left valve just behind the anterior cardinal angle. Ventral margin convex with an antero-median incurvature. Shell surface punctate with widely scattered, large,

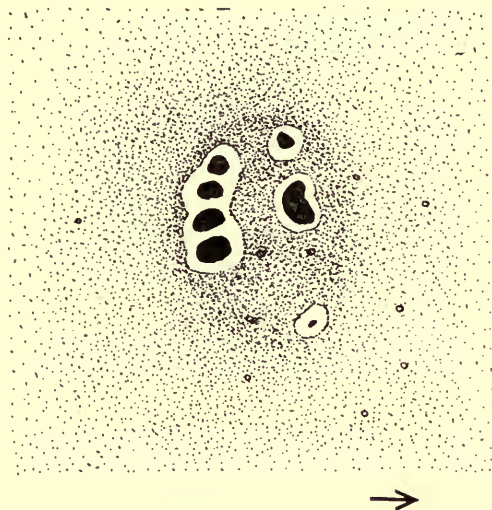


FIG. 5. Muscle scars, $\times 200$. *Schuleridea (Eoschuleridea) horatiana* (Jones & Sherborn), lectotype, I.1852.

rounded, normal pore canals. An elongate **eye swelling** is situated below the anterior cardinal angle in the right valve and has an oblique furrow situated beneath. **Muscle scars** as viewed externally of type C (Bate 1963). Anterior **radial pore canals** splayed fan-like around the anterior margin, largely concentrated below mid-height, approximately twenty-five to thirty in number. **Hinge** paleomerodont as seen in the right valve. Terminal teeth larger anteriorly, where there are five, than posteriorly, where there are eight. Median bar smooth. Left valve larger than right. Inner margin and line of concrescence coincide, anterior duplicature broad.

DIMENSIONS. I.1852, right valve, length 0.85 mm.; height 0.46 mm. Io.3940, carapace, length 0.79 mm.; height 0.46 mm.; width 0.36 mm.

REMARKS. Both available specimens of this species are male dimorphs as indicated by their shell outline. No female dimorph has been recognized. This species is very close to the male dimorph of *Schuleridea (Eoschuleridea) bathonica* Bate (1967) although the latter has fewer anterior radial pore canals and does not have the line of greatest length as ventrally positioned as in *horatiana*. Male dimorphs of *Schuleridea* species are notoriously alike and extremely difficult to tell apart. Until

a female dimorph has been identified for *horatiana* from the Fuller's Earth it is preferred to regard these two species as distinct.

Genus *ASCIOCY THERE* Swain 1952

Asciocythere obovata (Jones & Sherborn)

(Pl. 7, fig. 8; Pl. 8, figs. 2, 3, 7; Text-fig. 6)

1888 *Cytheridea obovata* Jones & Sherborn : 264, pl. 2, figs. 6a-c.

DIAGNOSIS. Carapace oval in lateral view, strongly convex in dorsal view. Dorsal margin broadly arched, curving down into well-rounded anterior and more narrowly rounded posterior margin without change in slope at cardinal angles. Ventral margin broadly convex. Line of greatest length slightly below mid-point. Shell surface very finely punctate.

LECTOTYPE. I.1836, right valve, figured Jones & Sherborn 1888, pl. 2, figs. 6a-c, from the Yellow Fuller's Earth Clay.

PARALECTOTYPE. Io.3938, carapace from the Yellow Fuller's Earth Clay, Winwood Collection.

OTHER MATERIAL. Io.3939, left valve from the Blue Fuller's Earth Clay, Winwood Collection.

DESCRIPTION. Carapace oval in outline with strongly arched dorsal margin and indistinct cardinal angles, the dorsal margin curving down without a break into the rounded anterior margin and the more narrowly rounded posterior margin. Ventral margin broadly convex. Shell surface appears smooth but is in fact very finely punctate. Greatest length of carapace just below mid-point. Greatest height median; greatest width just behind mid-point. Left valve larger than right, overlapping the right along the ventral, posterior and postero-dorsal slopes. Antero-dorsally and anteriorly the valves tend to gape and there is no overlap. **Hinge** antimerodont: right valve with ten dorsally bifid anterior teeth and nine dorsally bifid posterior teeth. Median groove very short and loculate. Left valve hinge not seen. Inner margin and line of concrescence coincide, duplicature strongly developed. Anterior **radial pore canals** widely spaced and only very slightly curved, almost straight, sixteen in number. **Muscle scars** not observed.

DIMENSIONS. I.1836, right valve, length 0.54 mm.; height 0.34 mm.; Io.3938, carapace, length 0.49 mm.; height 0.35 mm.; width 0.30 mm. Io.3939, left valve, length 0.62 mm.; height 0.42 mm.

REMARKS. Only two species of *Asciocythere* have been described from the British Middle Jurassic so far; *A. lacunosa* Bate 1963a and *A. acuminata* Bate 1964, both from the Bajocian. The present species, the first to be described from the Bathonian, is not so posteriorly acuminate as *A. acuminata* and not so strongly pitted as *A. lacunosa*.

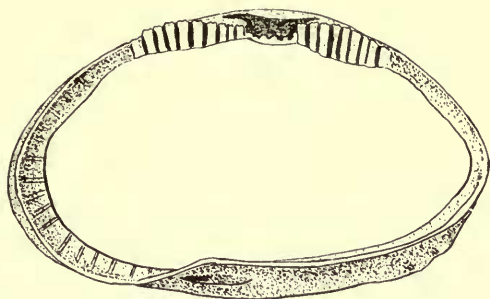


FIG. 6. *Asciocythere obovata* (Jones & Sherborn). Internal view, right valve, lectotype, I.1836. $\times 115$.

Genus **PRAESCHULERIDEA** Bate 1963

Praeschuleridea subtrigona subtrigona (Jones & Sherborn)

(Pl. 8, figs. 4-6)

1888 *Cytheridea subtrigona* Jones & Sherborn : 265, pl. 2, figs. 9a-c.

1963 *Praeschuleridea subtrigona* (Jones & Sherborn) Bate : 207, pl. 12, figs. 12-16, pl. 13, figs. 1-9.

1963a *Praeschuleridea subtrigona* (Jones & Sherborn); Bate : 41.

1964 *Praeschuleridea subtrigona subtrigona* (Jones & Sherborn); Bate : 22.

1965 *Praeschuleridea subtrigona subtrigona* (Jones & Sherborn); Bate : 124.

DIAGNOSIS. Carapace oval-subtrigonal in outline, punctate. Length of adult of the order of (female) 0.56 mm.; (male) 0.58 mm.

LECTOTYPE. I.1838, male right valve, not the figured specimen of Jones & Sherborn, which was of a left valve. Blue Fuller's Earth Clay.

PARALECTOTYPES. Io.3935-7, female and two male carapaces, Blue Fuller's Earth Clay, Winwood Collection.

REMARKS. *Praeschuleridea subtrigona* is the type species of the genus and as such has been described fully in earlier publications. Three subspecies are recognized so far, *subtrigona subtrigona* being the smallest and having the longest stratigraphical range: Middle Bajocian (*Sonninia sowerbyi* Zone, *Hyperlioceras discites* Subzone) to Upper Bathonian (*Prohecticoceras retrocostatum* Zone). The other two subspecies, *P. subtrigona magna* Bate (1964) and *P. subtrigona intermedia* Bate (1965), have much shorter ranges and are restricted to the Bajocian. The measurements of the type specimens have not previously been given and are included here.

DIMENSIONS. I.1838, male right valve, length 0.53 mm.; height 0.32 mm. Io.3935, male carapace, length 0.55 mm.; height 0.37 mm.; width 0.29 mm. Io.3936, male carapace, length 0.54 mm.; height 0.36 mm.; width 0.29 mm. Io.3937, female carapace, length 0.50 mm.; height 0.35 mm.; width 0.30 mm. Comparison of the above measurements with those given in Bate (1963 : 209) shows that the size of the *P. subtrigona subtrigona* has remained stable since the Bajocian.

Genus *EOCYTHERIDEA* Bate 1963*Eocytheridea* sp.

(Pl. 8, fig. 1)

REMARKS. Known from a single right valve, possibly of a male dimorph (Winwood Collection). The surface of the valve is strongly pitted by rather broad pits which, towards the centre of the valve, produce a reticulation but in the antero-dorsal and postero-dorsal areas are elongated obliquely towards the centre of the dorsal margin. This elongation produces a series of ridges which radiate down from the centre of the dorsal margin. The ornamentation readily distinguishes this species from *Eocytheridea faveolata* Bate (1964) which has a more uniform reticulate ornamentation without the development of obliquely radiating ridges in the dorsal part of the carapace. The hinge is hemimerodont. Twelve long, slightly curved anterior radial pore canals pass through the broad duplicature.

This is the first record of the genus outside the Bajocian

DIMENSIONS. Io.3906, right valve, length 0.77 mm.; height 0.36 mm.

Family CYTHERIDEIDAE Sars 1925

Subfamily CYTHERIDEINAE Sars 1925

Genus *HADROCYTHERIDEA* nov.

DERIVATION OF NAME. *hadros*, Gr., well developed + *cytheridea*.

DIAGNOSIS. Carapace robust, expanded posteriorly in both width and height. Hinge straight, antero-dorsal and postero-dorsal slopes steeply angled. Anterior end rounded, posterior end triangular in elongate male dimorph. Female with triangular posterior end, slightly upturned. Line of greatest length lower in female dimorph. Postero-ventral part of carapace characteristically swollen, particularly in the female. Hinge antimerodont. Inner margin and line of concrescence coincide; duplicature broad. Anterior radial pore canals long, straight, widely and uniformly spaced, nine in the type species. In front of a vertical row of four small, oval adductor scars, there is a bill-hook or broadly heart-shaped antero-dorsal antennal scar and a small antero-ventral mandibular scar. Left valve larger than the right. Shell surface coarsely pitted.

TYPE SPECIES. *Cytheridea dolabra* Jones & Sherborn 1888.

REMARKS. This new genus has been placed in the Cytherideidae on the basis of carapace morphology and muscle scar pattern. It is easily recognizable by its rectangular/quadrated outline, postero-ventral convexity and position of greatest height and width towards the posterior. The outline of the male dimorph is to some extent reminiscent of *Fabanella* Martin 1961, but that of the female is completely different.

Hadrocytheridea dolabra (Jones & Sherborn)

(Pl. 9, figs. 1-8; Pl. 10, fig. 1; Text-fig. 7)

1888 *Cytheridea dolabra* Jones & Sherborn : 267, pl. 3, figs. 3a-c.1888 *Cytheridea puteolata* Jones & Sherborn : 259, pl. 1, figs. 7a-c.1888 *Cytheridea parallela* Jones & Sherborn : 260, pl. 1, figs. 9a-c.1888 *Cytheridea pentagonalis* Jones & Sherborn : 261, pl. 2, figs. 1a-c.1888 ?*Cytheridea ignobilis* Jones & Sherborn : 268, pl. 3, figs. 9a-c.

DIAGNOSIS. *Hadrocytheridea* with robust dimorphic carapace. Shell surface finely punctate between distinct circular pits, at the centre of which is a large, circular normal pore canal opening. Other details as for genus.

LECTOTYPE. I.1851, female right valve, figured Jones & Sherborn 1888, pl. 3, figs. 3a-c. Blue Fuller's Earth Clay, Midford.

PARALECTOTYPES. I.1844, male left valve, figured Jones & Sherborn 1888, pl. 1, figs. 7a-c. This specimen was described by Jones & Sherborn as *Cytheridea puteolata* and is selected here as lectotype of that species. Additional paralectotypes of *C. puteolata* are Io.3921-2 from the Winwood Collection.

I.1859, male carapace, figured Jones & Sherborn 1888, pl. 1, figs. 9a-c. This was described as *Cytheridea parallela* and is here selected as lectotype of that species. Additional paralectotypes of *C. parallela* are Io.3924-8 from the Winwood Collection.

I.1866, female left valve, figured Jones & Sherborn 1888, pl. 2, figs. 1a-c. This is the holotype of *Cytheridea pentagonalis*.

All the above paralectotypes of *Hadrocytheridea dolabra* apart from I.1866, which comes from the Yellow Fuller's Earth Clay, come from the Blue Fuller's Earth Clay of Midford, near Bath.

OTHER MATERIAL. Jones & Sherborn (1862 : 262) stated that *Cytheridea pentagonalis* was represented by a single specimen only. Two single right valves of this species, Io.273 and Io.3929, also occur in the Winwood Collection from the Blue Fuller's Earth Clay but cannot be regarded as paralectotypes.

DESCRIPTION. Carapace quadrate with sharply angled, prominent cardinal angles and steeply sloping antero- and postero-dorsal slopes in the female dimorph, elongate, more rectangular in outline in the male. Dorsal margin straight, ventral margin medially incurved. Anterior end broadly rounded in the left valve, truncated dorsally in the right by the steeply sloping antero-dorsal slope. In the queried juvenile right valve this truncation of the anterior margin is not present. Posterior end triangular, the postero-dorsal slope strongly concave in the female, resulting in a distinct upturning of the posterior end in both valves but more strongly so in the right. In the male this upturning is restricted to the right valve. Greatest length of carapace below mid-point in both dimorphs but more ventrally situated in the female. Greatest height and width developed in the posterior third of the carapace. In the male the increase in width posteriorly is uniformly developed in that area. In the female the increase in width tends to be restricted to the postero-ventral region. Left valve larger than the right, with the left overlapping the right along the ventral



FIG. 7. *Hadrocytheridea dolabra* (Jones & Sherborn). Muscle scars of lectotype of *Cytheridea puteolata* Jones & Sherborn, from the exterior. I.1844. $\times 500$.

margin. Elsewhere there does not appear to be any overlap. Shell surface very finely punctate in between the large circular pits, each of which has a large normal pore canal opening at its centre. **Hinge** antimerodont, strongly developed with five anterior and five posterior teeth. Median groove loculate. Inner margin and line of concrescence coincide to produce a broad duplicature through which pass (anteriorly) nine, long, straight and widely-spaced **radial pore canals**. **Muscle scars** consist of a vertical row of four small, oval adductor scars, a small, round antero-ventral mandibular scar and a large antero-dorsal antennal scar which is equal in size to two adductor scars and is either heart-shaped or bill-hooked in outline.

DIMENSIONS. I.1851, female right valve, length 0.64 mm.; height 0.38 mm. I.1844, male left valve, length 0.71 mm.; height 0.34 mm. I.1859, male carapace, length 0.73 mm.; height 0.36 mm.; width 0.37 mm. I.1866, female left valve, length 0.57 mm.; height 0.32 mm. Io.3294, male right valve, length 0.65 mm.; height 0.31 mm. I.1868, ?juvenile right valve, length 0.46 mm.; height 0.26 mm.

REMARKS. Jones & Sherborn (1888) described four different species which were either male or female dimorphs of a single species. Although *Cytheridea puteolata* had page preference it was decided to select a female dimorph as type because it is the female outline which is continuous with juvenile instars. Of the two female specimens available, that identified as *Cytheridea dolabra* was the better preserved and was therefore chosen to identify the species. The breakdown of the synonymous species is as follows:

Female right valve	.	.	<i>Cytheridea dolabra</i>
Female left valve	.	.	<i>Cytheridea pentagonalis</i>
Male carapace	.	.	<i>Cytheridea parallela</i>
Male left valve	.	.	<i>Cytheridea puteolata</i>
? Juvenile instar	.	.	<i>Cytheridea ignobilis</i>

Hadrocytheridea dolabra is close to *Cytheridea punctiputeolata* Jones & Sherborn, as far as the male right valve is concerned, but *C. punctiputeolata* has a lophodont hinge, more rounded posterior end and a more strongly developed ornamentation of punctae and pits. *Cytheridea ignobilis* has been included in this species as it probably represents a juvenile instar. However, because of the slight difference between the anterior margin of *C. ignobilis* and that of *H. dolabra* and the absence of other juveniles to establish an ontogenetic sequence, *C. ignobilis* is doubtfully referred to this species and is not placed in the list of paralectotypes.

Family **PROGONOCYTHERIDAE** Sylvester-Bradley 1948

Subfamily **PROGONOCYTHERINAE** Sylvester-Bradley 1948

Genus **RECTOCYTHERE** Malz 1958

Rectocythere sugillata (Jones & Sherborn)

(Pl. 10, figs. 3-6)

1888 *Cytheridea sugillata* Jones & Sherborn : 262, pl. 2, figs. 2a-c.

DIAGNOSIS. *Rectocythere* with surface ornamentation of irregular ridges and raised areas giving parched or shrivelled-up appearance. Coarsely pitted in well-preserved specimens.

LECTOTYPE. I.1855, left valve figured Jones & Sherborn 1888. Blue Fuller's Earth Clay, Midford.

PARALECTOTYPE. Io.3930, right valve referred to by Jones & Sherborn 1888 : 262, Blue Fuller's Earth Clay, Winwood Collection.

DESCRIPTION. Shell robust, with high anterior and posteriorly sloping dorsal margin. Anterior end broadly rounded; posterior end narrowly rounded in the left valve, triangular in the right, with a concave postero-dorsal slope producing an upturned posterior end. Ventral margin slopes upwards towards the posterior end, but is over-hung postero-ventrally by the prominent convexity of the ventro-lateral margin in that region. Anterior and posterior marginal borders flattened, the convex central part of the carapace is strongly ornamented by irregular ridges and raised areas which give a dehydrated appearance to the ostracod. **Hinge** lophodont. Inner margin and line of concrescence coincide producing a rather broad duplicature. To the outside of this there is developed a narrow flange extending around the anterior margin and along the ventral margin to the apex of the posterior end. Anterior **radial pore canals** long and straight, widely spaced and about seven to eight in number. **Muscle scars** not observed.

DIMENSIONS. I.1855, left valve, length 0.50 mm.; height 0.31 mm. Io.3930, right valve, length 0.51 mm.; height 0.32 mm.

REMARKS. *Rectocythere sugillata* possesses the same basic ornamentation as *R. rugosa* Malz (1966a : 405, figs. 6-9) but may be distinguished by having a much

finer degree of surface pitting and additional irregular swellings. Dr. Malz kindly sent material of *R. rugosa* for comparison.

The ostracod *Camptocythere lincolnensis* Bate (1963 : 201, pl. 10, figs. 2-13) also belongs to *Rectocythere* on its similarity of carapace outline, ornamentation and internal details.

Genus *CAYTONIDEA* Bate 1965

DIAGNOSIS. Progonocytherinae, oval-rectangular in outline with well-rounded anterior and posterior margins. Low eye swelling situated at anterior cardinal angle. Cardinal angles prominent, broadly rounded. Shell surface with reticulate ornamentation. Hinge antimerodont. Muscle scars consist of subvertical row of four adductor scars, rounded antero-dorsal antennal scar and rounded antero-ventral mandibular scar. Radial pore canals long, straight, few in number. Left valve larger than right. Dimorphic.

REMARKS. Since the publication of this genus a second species has been identified which enables some modification to the diagnosis to be made. This concerns the identification of dimorphism and the determination of a reticulate ornamentation as a constant feature.

A re-examination of the type species, *Caytonidea faveolata* Bate (1965 : 100, pl. 1, figs. 13-14, pl. 2, figs. 1-10), has shown that the holotype (Io.1831) is a female dimorph and the paratype (Io.1834) a male.

Caytonidea terraefullonicae (Jones & Sherborn)

(Pl. 10, figs. 2, 7, 8; Pl. 11, figs. 1-3)

1888 *Cytheridea terrae-fullonicae* Jones & Sherborn : 258, pl. 1, figs. 5a-c.

DIAGNOSIS. *Caytonidea* with coarse reticulate ornamentation of five- to six-sided pits covering entire shell surface. Extreme postero-ventral margin swollen, slightly overhanging ventral surface. Males more elongate in outline than females.

LECTOTYPE. I.1869, left valve, figured Jones & Sherborn 1888. Blue Fuller's Earth Clay, Midford.

PARALECTOTYPES. Io.3917-20, male and female specimens from the Winwood Collection, Blue and Yellow Fuller's Earth Clay, Midford.

OTHER MATERIAL. Io.4002-3, right valve and juvenile carapace from the J. F. Blake Collection, Fuller's Earth Clay, Bath.

DESCRIPTION. Carapace rectangular in outline, especially in the male dimorph, with sub-parallel dorsal and ventral margins. Anterior end high with greatest height through the anterior cardinal angle which is situated close to the anterior margin. Anterior end broadly but slightly obliquely rounded and extended ventrally below the ventral margin. Posterior end broadly rounded in the left valve, with

oblique postero-dorsal slope in the right valve. Postero-ventral margin slightly swollen and overhanging ventral surface. Greatest length of carapace passes slightly below the mid-point; greatest width in the posterior third. There are no marginal borders. Left valve slightly larger than the right which it overlaps along the ventral margin but very little elsewhere. Shell surface coarsely reticulate, the reticulations producing five- to six-sided pits which cover the entire shell surface. In the juvenile carapace, the reticulations tend to form longitudinal ridges along the ventral surface. **Normal pore canals** large and widely spaced over the surface of the carapace. Inner margin and line of concrescence coincide to produce a broad duplicature through which pass a small number (about seven) of long, straight, and widely spaced anterior **radial pore canals**. A narrow flange extends around the anterior and ventral margins and along the postero-ventral part of the posterior margin. **Hinge** antimerodont, the median element being long and finely denticulate/locellate. Terminal elements dentate/loculate. **Muscle scars** as seen from the exterior consist of a small, rounded antero-dorsal antennal scar and a vertical row of four rounded adductor scars (type A). An oval smooth area in the region of the anterior cardinal angle is indicative of an **eye swelling**. This feature is only clearly seen in the male dimorph.

DIMENSIONS. I.1869, female left valve, length 0.54 mm.; height 0.30 mm. Io.3919, female right valve, length 0.49 mm.; height 0.26 mm. Io.3917, male right valve, length 0.54 mm.; height 0.26 mm. Io.3918, male left valve, length 0.55 mm.; height 0.26 mm. Io.3920, female carapace, length 0.52 mm.; height 0.29 mm.; width 0.25 mm.

REMARKS. *Caytonidea terraefullonicae* differs from *C. faveolata* Bate in the possession of a much stronger reticulate ornamentation, straighter dorsal margin, and postero-ventral swelling slightly overlapping the ventral surface. Unfortunately, during the examination of this material Io.3918 was lost and Io.3917 damaged.

Genus *ACANTHOCY THERE* Sylvester-Bradley 1956

Acanthocythere sphaerulata (Jones & Sherborn)

(Pl. II, figs. 4-6)

1888 *Cythere sphaerulata* Jones & Sherborn : 253, pl. I, figs. 6a-c.

1956 *Acanthocythere sphaerulata* (Jones & Sherborn) Sylvester-Bradley : 12, pl. I, figs. 1-4.

DIAGNOSIS. As for Sylvester-Bradley 1956 : 12.

HOLOTYPE. I.1835, female carapace, length 0.52 mm.; height 0.31 mm.; width 0.31 mm. Figured Jones & Sherborn 1888. Blue Fuller's Earth Clay, Midford.

REMARKS. *Cythere sphaerulata* was made the type species of *Acanthocythere* (Sylvester-Bradley 1956), additional material indicating that the species was dimorphic. A misprint on p. 12 stated that the holotype was a male dimorph; it is, in fact, a female dimorph.

Genus *FASTIGATOCY THERE* Wienholz 1967

Fastigatocythere juglandica (Jones)

(Pl. 12, fig. 3)

1888 *Cythere juglandica* var. *major* Jones & Sherborn : 255, pl. 4, figs. 2a, b.

REMARKS. The synonymy and diagnosis of this species are given on p. 389. The variety described by Jones & Sherborn, of which the specimen I.1872 is holotype was correctly placed in synonymy by Sylvester-Bradley (1948).

DIMENSIONS. I.1872, female left valve, length 0.74 mm.; height 0.49 mm.

Genus *GLYPTOCY THERE* Brand & Malz 1962

Glyptocythere guembeliana (Jones)

(Pl. 3, fig. 2; Pl. 4, fig. 1)

1884 *Cythere guembeliana* Jones : 772, pl. 34, figs. 32, 33 [not fig. 31].

1888 *Cytheridea pulvinar* Jones & Sherborn : 266, pl. 3, figs. 2a-c.

1888 *Cytheridea trapezoidalis* Terquem, Jones & Sherborn : 270, pl. 4, figs. 1a, b.

1967 *Glyptocythere guembeliana* (Jones) Bate : 49, pl. 13, figs. 10-16, pl. 14, figs. 1-8.

REMARKS. This species has been described fully by me (Bate 1967) although I omitted to include the ostracod identified by Jones & Sherborn as *Cytheridea trapezoidalis* Terquem. This specimen is a juvenile instar of *G. guembeliana*. Although it has a well-developed ventro-lateral keel, the outline of the valve is typically juvenile in being strongly acuminate posteriorly. The hinge, in being anti-merodont, reflects an early stage in the development of the adult entomodont hinge.

DIMENSIONS. I.1858, female right valve (*Cytheridea pulvinar*), length 0.82 mm.; height 0.47 mm. I.1840, juvenile right valve (*Cytheridea trapezoidalis*), length 0.54 mm.; height 0.30 mm.

Glyptocythere oscillum (Jones & Sherborn)

(Pl. 5, fig. 2; Pl. 12, fig. 2; Text-figs. 8, 9)

1888 *Cythere oscillum* Jones & Sherborn : 254, pl. 3, figs. 8a-c.

1888 *Cytheridea striblitia* Jones & Sherborn : 268, pl. 3, figs. 7a-c.

DIAGNOSIS. Carapace strongly ornamented with series of grooves and irregular swollen areas: two lateral grooves developed, the first ventro-laterally, the second just above valve middle, both joined by narrow vertical groove passing between two swollen areas. Broad dorso-median sulcus extends down to median groove. Area below ventro-lateral groove alate in right valve, swollen in both valves. From posterior region, two swollen areas extend towards valve centre whilst two similar areas extend back from anterior region. Lower of anterior swollen area terminates in prominent swelling. Anterior and posterior swollen areas do not unite. Normal pore canals prominently displayed over carapace.

HOLOTYPE. I.1849, described, figured Jones & Sherborn (1888). Female right valve from the Blue Fuller's Earth Clay, Midford.

OTHER MATERIAL. Io.3943, male left valve, referred to Jones & Sherborn (1888). Winwood Collection. Blue Fuller's Earth Clay, Midford. This is the lectotype of *Cytheridea stribblita* Jones & Sherborn. Io.3914-6, two male left valves and a male right valve, Winwood Collection, Blue Fuller's Earth Clay, Midford.

DESCRIPTION. Carapace subquadrate to sub-rectangular in outline, the more elongate specimens being the males. Greatest length through the mid-point in the male dimorph, below in the female right valve. Greatest height in the posterior third. Dorsal margin, in the left valve, concave in the region of the dorso-median sulcus, convex posteriorly. The dorsal margin of the right valve is strongly convex, especially in the female. Cardinal angles particularly well developed in the right valve, postero-dorsal slope concave in both valves, more especially so in the female right valve. Antero-dorsal slope broadly convex in the male, concave in the female right valve. Anterior end broadly rounded, posterior end triangular. Ventral margin antero-medially concave, posteriorly convex. Ventro-lateral margin of right valve becomes alate, extending below ventral surface. This feature does not appear to be so well developed in the left valve. Anterior and posterior marginal borders flattened. Shell surface ornamented as described in the diagnosis. Normal pore canal openings prominent and widely scattered over the carapace. **Hinge** with five to six terminal teeth in the right valve and a median loculate groove. In the left valve the terminal loculate sockets are separated by a median bar which is rather coarsely dentate, particularly in the anterior part. Although not as well developed as in some species the hinge is regarded as entomodont. Inner margin and line of concrescence coincide. Anterior **radial pore canals** long and straight, widely spaced, about ten in number. **Muscle scars** not seen.

DIMENSIONS. Lectotype, I.1849, female right valve, length 0.53 mm.; height 0.30 mm. Io.3943, male left valve, length 0.62 mm.; height 0.32 mm. Io.3916, male right valve, length 0.59 mm.; height 0.30 mm.

REMARKS. Jones & Sherborn identified the female specimens of the present species as *Cythere oscillum*; the males they placed in *Cytheridea stribblita*. The figured specimen of the latter species has been lost but the lectotype of *C. stribblita* was found in the Winwood Collection.

Glyptocythere rudimenta Brand & Malz (1962 and 1966) is similar to *G. oscillum* in ornamentation but differs in that the anterior and posterior swollen areas take the form of rather thin irregular ridges, not nearly so broad as in *oscillum*. A broad sulcus is developed in *oscillum* in the dorso-median area, but in *rudimenta* there is a series of irregular ridges radiating down from the dorsal margin. The shell outline in the right valve is noticeably different, the cardinal angles and the dorso-median extension of the dorsal margin being very much more prominently developed in *G. oscillum*. The similarities in ornamentation between the two species suggests a phylogenetic relationship which is supported by their stratigraphic position, *G. rudimenta* being found in the Upper Bajocian and *G. oscillum* in the Upper

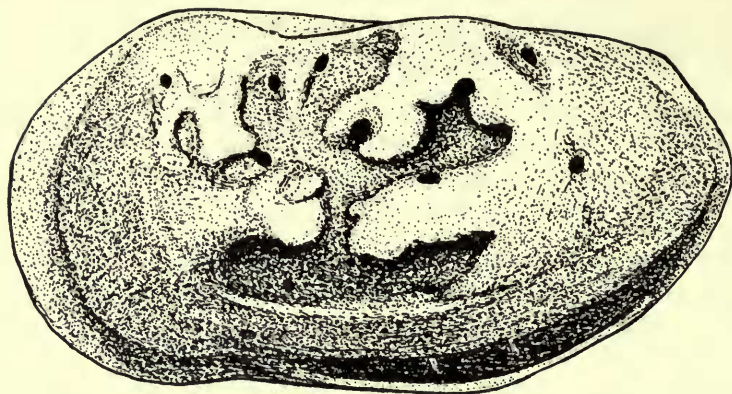


FIG. 8. *Glyptocythere oscillum* (Jones & Sherborn). Male left valve, paralectotype, Io.3943. $\times 153$.

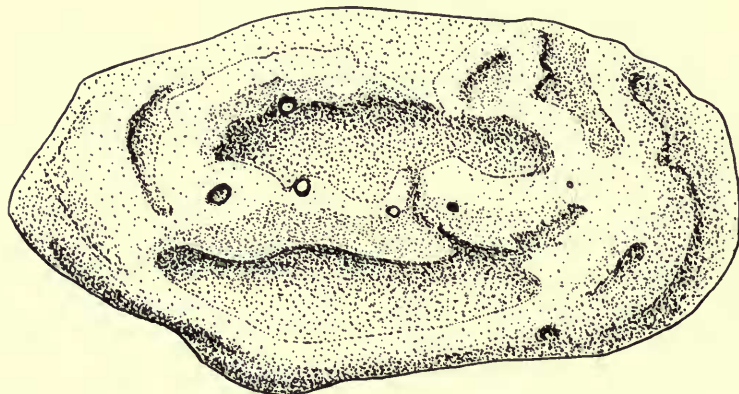


FIG. 9. *Glyptocythere oscillum* (Jones & Sherborn). Male right valve, Io.3916. $\times 165$.



FIG. 10. *Glyptocythere rudimenta* Brand & Malz. Left valve, female carapace. Io.3921. $\times 113$.

Bathonian. The kindness of Dr. D. E. Brand in sending me specimens of *G. rudimenta* is acknowledged here.

Glyptocythere persica (Jones & Sherborn)

(Pl. 12, fig. 1; Text-fig. 11)

1888 *Cytheridea persica* Jones & Sherborn : 270, pl. 4, fig. 4.

DIAGNOSIS. Carapace with broad dorso-median depression in anterior half; short, blade-like ventral keel on ventral surface and ventro-lateral margin develops into keel-like ridge. Lateral surface ornamented by neat reticulation. Ventral surface with low, longitudinal ridges. Anterior and posterior marginal borders smooth, compressed.

HOLOTYPE. I.1834, right valve, figured Jones & Sherborn (1888), Blue Fuller's Earth Clay, Midford.

OTHER MATERIAL. Io.4006, juvenile carapace, Möckler Collection, Fuller's Earth, Midford.

DESCRIPTION. Carapace with greatest height at the anterior end, through the anterior cardinal angle, tapering to the posterior end. Dorsal margin broadly convex, sloping to the posterior, ventral margin with a broad, median incurvature, below which in the right valve there is lip-like extension of the flange. The flange is continuous around the anterior margin and along the ventral margin to the tip of the triangular posterior end. Anterior end broadly rounded, posterior end with

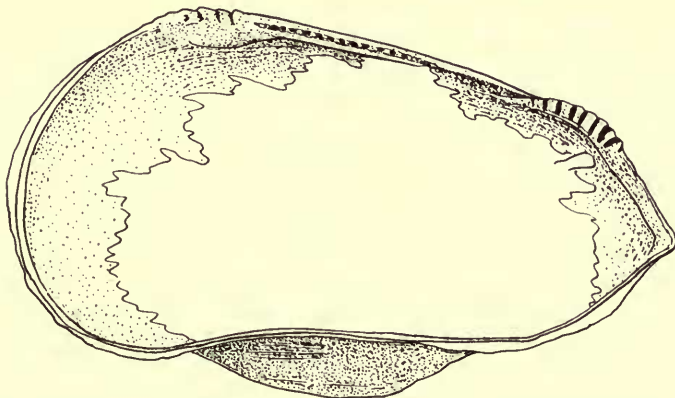


FIG. 11. *Glyptocythere persica* (Jones & Sherborn). Internal view of right valve. Holotype, I.1834. $\times 120$.

concave postero-dorsal slope and convex postero-ventral slope. Anterior and posterior marginal borders compressed and smooth, distinct from the more strongly convex part of the carapace which is ornamented by a neat reticulation. The ornamentation is extended along the ventro-lateral margin to form a keel-like ridge. Ventral surface ornamented by four longitudinal ridges, one of which is developed

into a short, blade-like keel. A smooth area at the anterior cardinal angle is suggestive of an ocular lens. Just anterior of valve centre and in the dorso-median part of the carapace a broad shallow sulcus is developed, especially noticeable in dorsal view. The posterior part of the valve behind the sulcus is noticeably more convex, whilst at the base of the sulcus, a raised area locates the position of the muscle scars. The left valve is larger than the right, which it overlaps along the ventral margin and slightly overreaches along the dorsal margin. The inner margin and line of concrescence coincide. The **hinge** is weakly entomodont.

DIMENSIONS. I.1834, right valve, length 0.70 mm.; height 0.38 mm. Io.4006, juvenile carapace, length 0.52 mm.; height 0.28 mm.; width 0.24 mm.

REMARKS. *Glyptocythere persica*, with its neat, reticulate ornamentation, distinct ventro-lateral ridge, and well-developed ventral, blade-like keel, is quite distinct from those species which possess well-developed ventro-lateral ridges or keels, e.g. *Glyptocythere costata* Bate (1965) and *G. guembeliana* (Jones) (Bate 1967), or from those which have a much stronger reticulate ornamentation, e.g. *Glyptocythere tuberodentina* Brand & Malz (1962a).

Genus **LOPHOCY THERE** Sylvester-Bradley 1948

BRADIANA GROUP

Lophocythere acutiplicata (Jones & Sherborn)

(Pl. 1, fig. 8; Pl. 12, figs. 4, 6)

1888 *Cytheridea acutiplicata* Jones & Sherborn : 271, pl. 4, figs. 7a-b, 8a-c.

DIAGNOSIS. Carapace dimorphic, tapering posteriorly. Eye swelling below anterior cardinal angle. Shell surface weakly ornamented laterally, the most prominent ridge being situated ventro-medially on the valve and extending from posterior margin to anterior margin. A second lateral ridge just above also extends down to the anterior margin, but cannot be traced backwards beyond the anterior third where it dies out. Two short ridges branch off the ventro-median ridge a short distance back from the anterior margin. The uppermost ridge is very short and extends into valve centre at an acute angle whilst the lower extends below the ventro-median ridge, parallel to it for almost three-quarters of its length. Three short lateral ridges are situated in the dorso-median part of the posterior third. A short ridge extends down from the eye swelling to die out above mid-length. Ventro-median part of carapace convex, extended below ventral surface. On this extension the left valve has a single ridge extending almost from the anterior margin to the posterior margin, with a short lateral ridge below it in the anterior part of the valve. In the right valve there are two lateral ridges in this region, both convex ventrally. The upper extends the length of the posterior half of the valve whilst the ridge slightly offset below it extends the length of the anterior half with some overlap of the two at valve middle. Normal pore canals prominent. Hinge antimerodont. Left valve larger than right.

LECTOTYPE. I.1863, female carapace, figured Jones & Sherborn (1888), Blue Fuller's Earth Clay, Midford.

PARALECTOTYPES. I.1847, female right valve, figured Jones & Sherborn (1888), Blue Fuller's Earth Clay, Midford. Io.3642-45, two male and one female right valve from the Blue Fuller's Earth Clay and one female right valve from the Yellow Fuller's Earth Clay, Midford, Winwood Collection.

DESCRIPTION. Carapace with a strong posterior taper in both dimorphs, of which the male is the more elongate. Anterior end high, broadly rounded, the greatest height being through the anterior cardinal angle, just below which is a low eye swelling. Posterior end triangular, narrow, with concave postero-dorsal slope and convex postero-ventral slope. Posterior cardinal angle prominent. Greatest length passes through the mid-point, greatest width in the posterior third although the width in the anterior third is almost the same. Carapace constricted slightly about centre when viewed dorsally. Normal pore canals large and prominently displayed over the carapace. Shell surface ornamented as in the diagnosis. Left valve larger than the right, which it overlaps along the ventral margin and overreaches along the dorsal margin. **Hinge** antimerodont, only seen in the right valve where there are four to five terminal teeth and a rather long, delicate, loculate median groove. The hinge is particularly delicate, and the carapace as a whole appears to be thin-shelled. Inner margin and line of concrescence coincide. **Radial pore canals** and **muscle scars** not observed. A narrow flange extends around the anterior and ventral margins and along the ventral part of the posterior.

DIMENSIONS. I.1863, female carapace, length 0.57 mm.; height 0.31 mm.; width 0.25 mm. I.1847, female right valve, length 0.54 mm. (broken); height 0.32 mm. Io.3643, male right valve, length 0.65 mm.; height 0.33 mm. Io.3644, female right valve, length 0.58 mm.; height 0.33 mm. Io.3645, female right valve, length 0.56 mm.; height 0.31 mm.

REMARKS. The carapace morphology and surface ornamentation agree closely with the basic characters of those ostracods which may be placed in the *bradiana* grouping of *Lophocythere*. Apart from the details of the radial pore canals and muscle scars, which are not so far known for *L. acutiplicata*, the only character in disagreement with this classification is the hinge, which, being antimerodont, is at once at variance with all the other species of *Lophocythere*. An antimerodont hinge is normally accepted as present in juvenile instars of adults having an entomodont hinge; here the delicate shell, strong posterior taper and comparatively small size would indicate this if it were not for the presence of strong dimorphism suggesting adult status. Sexual dimorphism is known, however, in pre-adult instars. As only right valves are available for the examination of internal features, it is not intended to suggest a subgeneric rank for this species, until additional material becomes available. In ornamentation *L. acutiplicata* may be distinguished easily by the number of lateral ridges, their tendency to fade out in the posterior part of the carapace, and by the development of two ventro-lateral keels in the right valve.

Lophocythere bradiana (Jones)

(Pl. 4, figs. 2, 3; Text-fig. 4)

REMARKS. The species has already been described (p. 390).

DIMENSIONS. I.1854 (lectotype of *C. craticula* figured Jones & Sherborn, pl. 4, figs. 10a-c), length 0.62 mm.; height 0.32 mm.; width 0.32 mm. I.1867 (paralectotype of *C. craticula* figured Jones & Sherborn, pl. 4, figs. 9a-c) left valve, length 0.60 mm.; height 0.32 mm.

Lophocythere septicostata Bate

(Pl. 12, fig. 8)

1888 *Cytheridea bradiana* Jones & Sherborn : 272, pl. 4, figs. 11a-c.

1967 *Lophocythere septicostata* Bate : 52, pl. 15, figs. 7-13, pl. 16, figs. 1-4.

DIAGNOSIS. *Lophocythere* having seven longitudinal ridges on lateral surface and two on ventral surface. Vertical ridge extends downwards from oval eye swelling. Interspaces between ridges punctate, with large, circular, normal pore canal openings. Anterior and posterior marginal borders compressed.

REMARKS. For remarks relating to this species see Bate (1967).

DIMENSIONS. I.1843, female right valve, length 0.64 mm.; height 0.33 mm.

Lophocythere sp.

(Text-fig. 12)

REMARKS. A single left valve in the Winwood Collection represents a new species of *Lophocythere*. It comes from the Blue Fuller's Earth Clay of Midford and is of the *Bradiana* Group. The arrangement of the lateral ridges is quite different from that in any described species. The dorsal ridge commences at the anterior margin, bends sharply upwards to pass through the eye swelling and then in an undulating

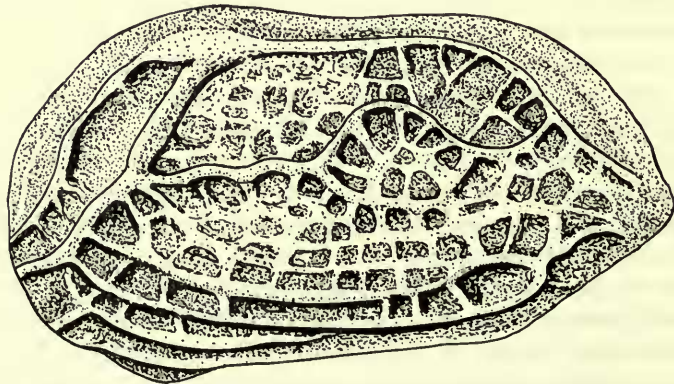


FIG. 12. *Lophocythere* sp. External view, right valve. Io.3900. $\times 170$.

course parallels the dorsal and postero-dorsal margins to die out at the extreme posterior. The median ridge commences at the anterior margin just below the dorsal ridge and soon bifurcates, the ventral branch extending back into the posterior third. A second ridge branches from the median ridge a short distance above the first bifurcation and extends into the posterior third where it unites with the first bifurcation. Both then extend to the posterior margin as a single narrow ridge. The median ridge continues its dorsal course and bifurcates yet again, the dorsal branch continuing until it fuses with the dorsal ridge just behind the eye swelling; the other branch passes laterally back into the posterior half of the valve, splits into a reticulate complex of smaller ridges but re-forms to fuse with the dorsal ridge in the posterior quarter. Two ventral ridges originate at the anterior margin, the lower extending back into the posterior half of the valve whilst the upper is restricted to the anterior half only. Interspaces between the ridges are reticulate. Hinge strongly entomodont.

DIMENSIONS. Io.3900, left valve, length 0.50 mm.; height 0.27 mm.

OSTREATA GROUP

Lophocythere fulgurata (Jones & Sherborn)

(Pl. 12, fig. 7)

1888 *Cytheridea fulgurata* Jones & Sherborn : 273, pl. 4, figs. 12a-c.

DIAGNOSIS. Carapace sub-rectangular, tapering to the posterior. Oval, clear eye swelling at anterior cardinal angle. Anterior and posterior marginal areas flattened, smooth. Central part of carapace strongly convex, ornamented by two prominent ridges. The first, L-shaped, commences at the eye swelling, extends vertically down to the antero-ventral part of the valve, where it performs a right-angle, and runs laterally backwards to the edge of the posterior marginal area. A second lateral ridge arises just below the right-angled bend of the first ridge and extends backwards, paralleling the ridge above it, to die out in a similar position at the edge of the posterior marginal border. The area inside the "L" of the first ridge is occupied by strong ridges radiating down from the dorsal margin and occasionally branching.

LECTOTYPE. I.1832, right valve, figured Jones & Sherborn (1888), Blue Fuller's Earth Clay, Midford.

PARALECTOTYPES. Io.3646-8, right and left valves from the Blue Fuller's Earth Clay, Midford, Winwood Collection.

DESCRIPTION. Carapace sub-rectangular with dorsal margin sloping to posterior. Cardinal angles prominent, situated close to the anterior and posterior margins respectively. Anterior cardinal angle smooth, indicating the presence of an eye swelling. Line of greatest height passes through this point. Line of greatest length passes through the mid-point, or slightly below it. Anterior end high,

broadly rounded; posterior end small and triangular with a concave postero-dorsal slope and a convex postero-ventral slope. Ventral margin with a shallow antero-median incurvature. Shell surface ornamented as in the diagnosis; area between the ridges appears to be punctate. Hinge not well preserved, the median element in both valves having been damaged. Terminal elements consist of dentate ridges in the right valve and loculate sockets in the left. Median bar of the left valve, long, not clearly seen to be dentate, bounded above by a shallow accommodation groove. Median groove of the right valve, long and narrow, not seen to be loculate because of damage. Inner margin and line of concrescence coincide. **Radial pore canals** and **muscle scars** not seen. A narrow flange extends around the anterior margin and along the ventral margin to the tip of the posterior margin in the right valve.

DIMENSIONS. I.1832, right valve, length 0.77 mm.; height 0.42 mm. Io.3648, left valve, length 0.66 mm.; height 0.36 mm.

REMARKS. Although the median element of the hinge has been damaged, the appearance suggests that it was antimerodont instead of the entomodont hinge typical of the genus. The strongly tapering outline and the hinge suggest that the material is of a pre-adult instar, but it is doubtful whether the adult ornamentation would be different from that described above. Certainly there is no difference between the instars examined.

Lophocythere ostreata (Jones & Sherborn)

(Pl. 12, fig. 5; Text-fig. 13)

1888 *Cytheridea ostreata* Jones & Sherborn : 271, pl. 4, figs. 6a-c.

1888 *Cytheridea bicarinata* Jones & Sherborn : 270, pl. 4, figs. 5a-c.

1948 *Lophocythere ostreata* (Jones & Sherborn) Sylvester-Bradley : 195, pl. 14, figs. 1-4, pl. 15, figs. 1, 2.

1963 *Lophocythere ostreata* (Jones & Sherborn); Oertli : 42, pl. 28, fig. o, pl. 29, fig. o.

DIAGNOSIS. Species of *Lophocythere* with characteristic L-shaped ridge commencing at a large, clear eye node, extending down to the antero-ventral region, to bend back at a right-angle and extend to the edge of the posterior marginal border. Second, keel-like ridge starts below the previous ridge in the antero-ventral part of the valve and extends backwards, parallel to the first ridge to die out against the edge of the posterior marginal border. Shell surface coarsely reticulate, the reticulations strongly upstanding to produce an oblique row of three prominent areas, the first of which is antero-central in position, just inside the angle of the L-shaped ridge. The second is dorso-median in position, just behind mid-point, whilst the third is postero-dorsal in position. Two, sometimes three, minor raised reticulations may be situated below and behind the two most dorsal of the major raised areas. Ventral surface with minor longitudinal ridges.

HOLOTYPE. I.1833, right valve figured Jones & Sherborn (1888), Yellow Fuller's Earth Clay, Midford.

OTHER MATERIAL. Io.3945-7, two carapaces and two broken right valve fragments, Winwood Collection, Blue Fuller's Earth Clay, Midford. These were referred to by Jones & Sherborn (1888) and are syntypes of *Cytheridea bicarinata*, the figured specimen having been lost. Io.3945 is here selected lectotype of *C. bicarinata*.

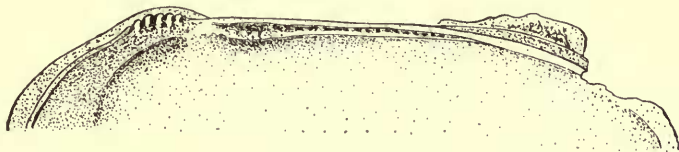


FIG. 13. *Lophocythere ostreata* (Jones & Sherborn). Internal view, right valve. Holotype, I.1833. $\times 105$.

DESCRIPTION. Carapace sub-rectangular with sub-parallel dorsal and ventral margins in the adult. Juvenile specimens have distinct posterior taper. Anterior end high, broadly rounded, posterior end triangular, with concave postero-dorsal slope and convex postero-ventral slope. Cardinal angles prominent, rounded. Anterior cardinal angle with well-developed, oval, clear eye node situated just below. Line of greatest length passes through the mid-point, line of greatest height through anterior cardinal angle and of greatest width through the posterior third of the carapace. Ornamentation as in the diagnosis. The reticulations continue into the lateral ridges and pass on to the anterior and posterior marginal borders. The postero-dorsal raised area is not developed in juvenile instars. Left valve larger than the right, which it overlaps along the ventral margin but overreaches around the anterior and posterior margins and in the region of the cardinal angles. **Hinge** weakly entomodont, seen only in the right valve: anterior dentate ridge with six teeth, posterior element not seen, median groove poorly preserved and not definitely seen to be loculate, expanded slightly in the anterior half. Inner margin and line of concrescence coincide to produce a broad duplicature. Selvage distinct, flange developed around the anterior margin, extending from the anterior cardinal angle, along the ventral margin to the tip of the posterior margin. **Radial pore canals** and **muscle scars** not observed.

DIMENSIONS. I.1833, right valve, length 0.81 mm.; height 0.40 mm. Io.3945, carapace, length 0.85 mm.; height 0.43 mm.; width 0.42 mm. Io.3947, juvenile carapace, length 0.60 mm.; height 0.31 mm.; width 0.28 mm.

REMARKS. The *Ostrea* Group of *Lophocythere* is characterized by the presence of two lateral keel-like ridges, the upper of which turns upwards to produce a reverse L-shaped ridge. The ornamentation within this "L" varies according to the species. In *L. ostreata* the reticulate ornamentation, extended into a number of upstanding areas, is quite unlike any described species. Exaggerations in the ornamentation of species within this group tend to be in the same position as the areas emphasized in *L. ostreata*. In this connection the closest species is *L. scabra* Triebel (1951), although it does not possess the strong reticulate ornamentation of *ostreata*.

Genus *MICROPNEUMATOCYTHERE* Bate 1963

Micropneumatocythere limaciformis (Jones & Sherborn)

(Pl. 13, fig. 1)

1888 *Cytheridea limaciformis* Jones & Sherborn : 269 pl. 3 figs. 12a-c.

DIAGNOSIS. Carapace oval/elongate with dorso-median area swollen, convex, projecting above dorsal margin in right valve; left valve with convex dorsal margin. Ventro-lateral and median part of ventral surface swollen, strongly convex, sometimes with weak longitudinal striae on ventral surface of convexity. Shell surface punctate. Normal pore canal openings large, circular, evenly spaced over the carapace.

HOLOTYPE. I.1831, male right valve, figured Jones & Sherborn (1888), Blue Fuller's Earth Clay, Midford.

OTHER MATERIAL. Io.276 and 4007, and Io.3944, female right and left valves from the Bradford Clay, Bradford-on-Avon, and male right valve from the Blue Fuller's Earth Clay, Midford. Winwood Collection.

DESCRIPTION. Carapace oval/elongate in outline, the more elongate specimens being the males. In the right valve of both dimorphs, especially the male, the dorso-median part of the valve is distinctly swollen, the convex surface projecting above the dorsal margin. Similarly the ventro-lateral part of the valve is also swollen but involves the ventral surface where, in some specimens, weak longitudinal striae are present. Left valve with uniformly convex dorsal and ventral margins. Anterior end uniformly rounded, posterior end triangular with concave postero-dorsal slope and convex postero-ventral slope, the posterior extremity tending to be upturned. Cardinal angles particularly distinct in the right valve, apparently separated from the central convexity of the valve by a shallow groove. Greatest length of carapace passes through the mid-point with the greatest height and width also at valve centre. Shell surface finely punctate with prominent, large, circular normal pore canal openings evenly spaced over the carapace. **Hinge** almost certainly antimerodont, the terminal dentate/loculate elements being clearly seen, whilst the median bar and groove is not sufficiently well preserved to state that it is a dentate/loculate structure. Inner margin and line of conrescence coincide, anterior **radial pore canals** straight, evenly spaced around the anterior margin, exact number not observed but no more than eight. A narrow flange extends around the anterior margin of the right valve and along the median part of the ventral margin. **Muscle scars** not seen.

DIMENSIONS. I.1831, male right valve, length 0.71 mm.; height 0.37 mm. Io.3944, male right valve, length 0.62 mm.; height 0.32 mm. Io.276, female right valve, length 0.56 mm.; height 0.36 mm. Io.4007, female left valve, length (damaged) 0.61 mm.; height 0.37 mm.

REMARKS. The closest species is *M. quadrata* Bate (1967), particularly in the case of the male dimorph. However, the characteristic development of a deep postero-

ventral slope in *M. quadrata* and the less strongly developed dorso-median convexity of the right valve distinguish this species from *M. limaciformis*.

Genus **PROGONOCYTHERE** Sylvester-Bradley 1948

Progonocythere stilla Sylvester-Bradley

(Pl. 13, fig. 2)

1948 *Progonocythere stilla* Sylvester-Bradley : 190, pl. 12, figs. 1, 2, pl. 13, figs. 1, 2.

1956 *Progonocythere stilla* Sylvester-Bradley; Grekoff : pl. 13, figs. 325-7.

1963 *Progonocythere stilla* Sylvester-Bradley; Oertli : 44, pl. 28, fig. n, pl. 29, fig. n.

DIAGNOSIS. *Progonocythere* with finely punctate shell surface, large, circular normal pore canal openings, somewhat irregularly scattered, tending to be concentrated towards centre of valve. Anterior end high, broadly rounded. Anterior cardinal angle close to anterior margin. Cardinal angles well rounded in left valve more distinctly angled in right. Dorsal margin convex in right valve, straight in left, in both valves steeply sloping to posterior. Posterior rounded in left valve, slightly angled in right. Anterior marginal border distinct from convexity of valve, ventro-lateral margin strongly convex, overhanging ventral margin. Left valve larger than the right. Hinge entomodont. Other internal features as for genus. Dimorphic.

REMARKS. *Progonocythere stilla*, the type species of the genus, was described by Sylvester-Bradley from the Bathonian Boueti Bed of Langton Herring. A single left valve (Io.3657) found in the Winwood Collection, from the Blue Fuller's Earth Clay of Midford, was not described by Jones & Sherborn. Three specimens (Io.3584-6) in the Möckler Collection are from the Fuller's Earth of Midford.

DIMENSIONS. Io.3657, left valve, length 0.60 mm.; height 0.43 mm.

Genus **TERQUEMULA** Blaszyk & Malz 1965

Terquemula blakeana (Jones)

(Pl. 4, fig. 8)

REMARKS. For synonymy and diagnosis see p. 393. The two specimens in the Jones & Sherborn Collection which have been placed in the synonymy are: *Cytheridea transversiplicata*, figured Jones & Sherborn 1888, pl. 3, figs. 4a-c, I.1828 (holotype), right valve, length 0.59 mm.; height 0.31 mm., and *Cytheridea blakeana* (Jones) Jones & Sherborn, figured pl. 2, figs. 11a-c. I.1853, left valve, length 0.60 mm.; height 0.31 mm. In addition a single right valve, Io.3941, has been found in the Winwood Collection from the Blue Fuller's Earth Clay, Midford.

INCERTAE SEDIS

The following ostracod species described by Jones & Sherborn are represented by single specimens only. They are retained here under their original names until comparative material enables a more precise determination.

“*Cythere*” *corrosa* Jones & Sherborn

(Pl. 13, fig. 4)

1888 *Cythere corrosa* Jones & Sherborn : 254, pl. 2, figs. 12a-c.

HOLOTYPE. I.1865, figured Jones & Sherborn (1888), Blue Fuller's Earth Clay, Midford.

REMARKS. This small ostracod resembles *Caytonidea* in outline and reticulate ornamentation, but differs in possessing a well-defined anterior marginal border. In *Caytonidea* the convex outline of the carapace continues without a break on to the anterior margin. Internal features not seen.

DIMENSIONS. I.1865, carapace, length 0.49 mm.; height 0.28 mm.; width 0.28 mm.

“*Cytheridea*” *aequabilis* Jones & Sherborn

(Pl. 13, fig. 3)

1888 *Cytheridea aequabilis* Jones & Sherborn : 257, pl. 1, figs. 1a-c.

HOLOTYPE. I.1864, figured Jones & Sherborn (1888), Yellow Fuller's Earth Clay, Midford.

REMARKS. *C. aequabilis* has a finely punctate carapace, rounded anterior and posterior margins, and parallel dorsal and ventral margins. In outline it is close to the unidentified ostracod figured by Bate (1964, pl. 13, figs. 5-8). Internal features not seen.

DIMENSIONS. I.1864, carapace, length 0.71 mm.; height 0.30 mm.; width 0.32 mm.

“*Cytheridea*” *coarctata* Jones & Sherborn

(Pl. 13, fig. 5)

1888 *Cytheridea coarctata* Jones & Sherborn : 259, pl. 1, figs. 3a-c.

HOLOTYPE. I.1841, figured Jones & Sherborn (1888), Blue Fuller's Earth Clay, Midford.

REMARKS. The unornamented carapace, well-rounded anterior and posterior margins, parallel dorsal and ventral margins, together with a muscle scar pattern in which the antero-dorsal antennal scar is crescentic in shape (type **B**), suggest *Homocytheridea* Bate (1963a). The left valve, the only known specimen, has been broken posteriorly and a more definite identification is not attempted.

DIMENSIONS. I.1841, left valve, length (broken) 0.56 mm.; height 0.26 mm.

"*Cytheridea*" *eminula* Jones & Sherborn
(Pl. 13, fig. 6)

1888 *Cytheridea eminula* Jones & Sherborn : 261, pl. 1, figs. 11a-c.

LECTOTYPE. I.1839, figured Jones & Sherborn (1888), Blue Fuller's Earth Clay, Midford.

REMARKS. This species is represented by a single left valve, although two specimens were included in the original description.

DIMENSIONS. I.1839, left valve, length 0.54 mm.; height 0.31 mm.

"*Cytheridea*" *punctiputeolata* Jones and Sherborn
(Pl. 13, fig. 8)

1888 *Cytheridea punctiputeolata* Jones & Sherborn : 258, pl. 1, figs. 4a-c.

HOLOTYPE. I.1856, figured Jones & Sherborn (1888), Blue Fuller's Earth Clay, Midford.

REMARKS. Although at first appearing to resemble the male dimorph of *Hadrocytheridea dolabra* the present species differs in the much more rounded of posterior margin, in the greater exaggeration of the ornamentation, which here consists of large, circular pits with the interspaces between distinctly punctate, and in the lophodont hinge.

DIMENSIONS. I.1856, right valve, length 0.73 mm.; height 0.32 mm.

"*Cytheridea*" *retorrida* Jones & Sherborn
(Pl. 15, fig. 3; Text-figs. 14, 15)

1888 *Cytheridea retorrida* Jones & Sherborn : 260, pl. 1, figs. 8a-c.

MATERIAL. Io.3923, Blue Fuller's Earth Clay, Midford. Winwood Collection.

REMARKS. The figured specimen was never presented and is presumed lost. A single carapace of this species has been found in the Winwood Collection, but

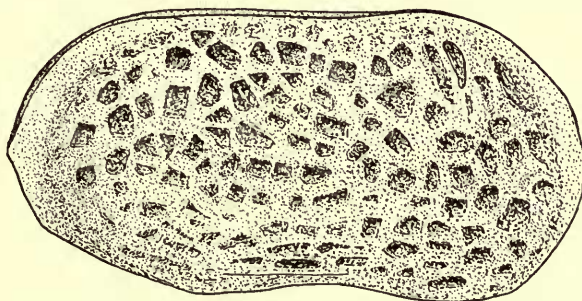


FIG. 14. *Cytheridea retorrida* Jones & Sherborn. Right valve, complete carapace. Io.3923. $\times 135$.

cannot be assigned to a known genus. Like *C. corrosa* it has some affinities with *Caytonidea* but has been excluded on the presence of distinct marginal borders. No internal features are known.

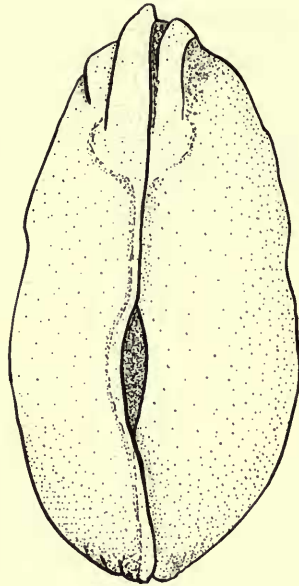


FIG. 15. *Cytheridea retorrída* Jones & Sherborn. Dorsal view of carapace with ornamentation omitted. Io.3923. $\times 135$.

DIMENSIONS. Io.3923, carapace, length 0.54 mm.; height 0.28 mm.; width 0.28 mm.

"*Cytheridea*" *spinifastigiata* Jones & Sherborn
(Pl. 13, fig. 7)

1888 *Cytheridea spinifastigiata* Jones & Sherborn : 264, pl. 2, figs. 8a-c.

HOLOTYPE. I.1861, figured Jones & Sherborn (1888), Blue Fuller's Earth Clay, Midford.

REMARKS. It is not possible to assign the single left valve to any known genus.

DIMENSIONS. I.1861, left valve, length 0.60 mm.; height 0.33 mm.

"*Cytheridea*" *spinigyrate* Jones & Sherborn
(Pl. 13, fig. 9)

1888 *Cytheridea spinigyrate* Jones & Sherborn : 264, pl. 2, figs. 7a-c.

HOLOTYPE. I.1860, figured Jones & Sherborn (1888), Blue Fuller's Earth Clay, Midford.

REMARKS. Jones & Sherborn (p. 264) compared this species with *Cythere drupacea* Jones but at the same time pointed out differences. The superficial similarity of *C. spinigyrate* to *C. drupacea* suggests that it, too, might belong to *Metacytheropteron* Oertli (1957).

DIMENSIONS. I.1860, right valve, length 0.61 mm.; height 0.34 mm.

IV. THE J. F. BLAKE COLLECTION

Order MYODOCOPIDA Sars 1866

Suborder CLADOCOPINA Sars 1866

Family POLYCOPIDAE Sars 1866

Genus *POLYCOPE* Sars 1866

Polycope fungosa sp. nov.

(Pl. 16, figs. 4, 9)

DIAGNOSIS. Carapace oval in adults, almost circular in juvenile instars. Shell surface strongly pitted with weak striae near and parallel to the free margin. Anterior end flattened, with marginal denticles. Hinge short, sunk in dorsal groove. Anterior cardinal angle prominent, antero-dorsal slope long, broadly convex with prominent overlap of left valve by the right. Posterior end broadly rounded, ventral margin strongly convex. Carapace distinctly angled at junction of antero-dorsal slope and anterior margin. Right valve larger than left.

HOLOTYPE. Io.3951, carapace, Fuller's Earth, Midford, near Bath.

PARATYPES. Io.3952-5, one adult and eighteen juvenile carapaces. Horizon and locality as above.

DESCRIPTION. Carapace in adult specimens oval in outline, laterally compressed. Lines of greatest length and height pass through the mid-point. Greatest width in the holotype situated at the extreme posterior end. A shallow central depression on the lateral surface marks the position of the muscle scars. Hinge margin situated in the posterior half of the carapace and sunk into a dorsal groove, at the anterior end of which the cardinal angle is prominently developed. Antero-dorsal slope long and convex, terminating in a sharply angled junction with the obliquely flattened anterior end. Posterior end broadly rounded, ventral margin broadly convex. Shell surface uniformly and distinctly pitted; striae are developed in the anterior and ventro-lateral regions. In dorsal view one stria on each valve can be seen to project beyond the anterior margin. Striations are arranged parallel to the free margins. Anterior margin may develop small denticles, though these, like the surface ornamentation, are generally absent from the juvenile instars. Right valve larger than the left, which it overlaps strongly along the antero-dorsal slope and less strongly around the posterior end. Internal features not observed.

DIMENSIONS. Io.3951, carapace, length 0.54 mm.; height 0.44 mm.; width 0.23 mm. Io.3952, carapace, length 0.46 mm.; height 0.37 mm.; width 0.20 mm.

Io.3953, juvenile carapace, length 0.32 mm.; height 0.27 mm.; width 0.09 mm.
Io.3954, juvenile carapace, length 0.26 mm.; height 0.22 mm.; width 0.01 mm.

REMARKS. A number of species of *Polycope* have been described from the Lower Jurassic (Apostolescu 1959; Fischer 1961 and Blake 1876), Middle Jurassic (Terquem 1885) and Upper Jurassic (Donze 1962 and Oertli 1959). *P. fungosa* differs from them all in the type of ornamentation present. A number of specimens in the Blake collection labelled *Polycope* sp. are probably juvenile specimens of the present species but lack the specific ornamentation.

Family **PROGONOCYTHERIDAE** Sylvester-Bradley 1948

Genus **TRACHYCYTHERE** Triebel & Klingler 1959

REMARKS. *Trachycythere* Triebel & Klingler (1959 : 343), first described from the Lias of Germany and later recorded from the Upper Bathonian of France (Oertli 1963), was placed in the Family Trachyleberididae (Moore 1961 : 341). Later Bate (1967a : 551) transferred it to the Progonocytheridae, a classification retained in this paper.

Trachycythere sp.

(Pl. 16, fig. 3)

REMARKS. A single left valve represents this Upper Bathonian species, which differs in being sub-rectangular with almost parallel dorsal and ventral margins, from two of the three species originally described by Triebel & Klingler, which have a more pronounced posterior taper. *Trachycythere verrucosa* Triebel & Klingler (1959) resembles this species in outline, but has stronger, more massive tubercles.

DIMENSIONS. Io.3966, left valve, length 0.45 mm.; height 0.25 mm.

Genus **HEKISTOCYTHERE** nov.

DERIVATION OF NAME. *Hekistos* (Gr.), least, + *cythere*.

DIAGNOSIS. A small genus with oval, posteriorly tapering carapace. Greatest height close to the anterior margin. Left valve larger than right. Hinge lophodont. Muscle scars of type A although antennal scar tends to be almost centrally situated in front of adductors. Radial pore canals straight, widely spaced, ten anteriorly, four posteriorly. Duplication narrow.

TYPE SPECIES. *Hekistocythere venosa* sp. nov.

Hekistocythere venosa gen. et sp. nov.

(Pl. 14, figs. 2, 4, 9; Pl. 15, fig. 7; Text-figs. 16-18)

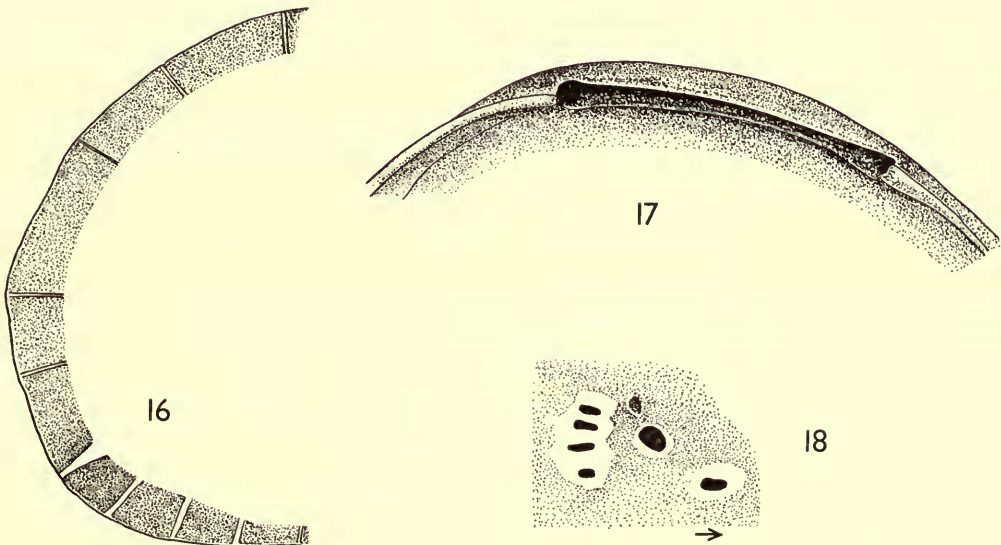
DIAGNOSIS. *Hekistocythere* with strongly ornamented carapace. Broad diagonal ridge extends from postero-dorsal to antero-ventral region of valve. Short, thick,

subsidiary ridges given off on dorsal and ventral sides of main ridge. Smaller intermediary ridges producing a reticulate ornamentation. Diagonal ridge produced at termination of, and at right-angles to, main ridge in postero-dorsal region.

HOLOTYPE. Io.3995, carapace, Fuller's Earth, Bath.

PARATYPES. Io.3996-9 (seven specimens) and Io.4011-3, Fuller's Earth, Bath.

DESCRIPTION. Carapace small with high, rounded anterior end and narrow, rounded posterior end. Carapace parallel-sided in dorsal view. Line of greatest length passes through the mid-point. Greatest width in either the anterior or



FIGS. 16-18. *Hekistocythere venosa* sp. nov. FIG. 16. Anterior radial pore canals. Paratype, Io.4013. $\times 300$. FIG. 17. Hinge, right valve, paratype, Io.4011. $\times 300$. FIG. 18. Muscle scars, left valve, paratype, Io.3997. $\times 300$.

posterior third, the carapace being slightly constricted medially. Dorsal margin convex, especially in the right valve where it projects slightly above that of the left valve. Surface ornamentation very coarsely reticulate, produced by a series of irregular ridges, the major of which extends down from the postero-dorsal part of the valve and extends to the antero-ventral region. From this ridge a number of irregular and shorter ridges branch off on its dorsal and ventral sides. One of the secondary ridges is particularly noticeable in dorsal view, and this leaves the primary ridge in the posterior part of the valve to extend dorsally in an antero-dorsal direction until it fuses with the dorsal margin. Left valve larger than the right, which it overlaps along the ventral margin and overreaches in the region of the antero- and

postero-dorsal slopes. Ventral surface flattened, triangular in outline, widening towards the posterior end. **Hinge** lophodont: right valve with smooth terminal elements which are the dorsal terminations of the selvage; median groove deeply recessed, smooth. Left valve with smooth terminal sockets open ventrally to the interior of the valve. Median bar long, smooth, convex, the convexity of the bar facing upwards. Inner margin and line of concrescence coincide, the duplicature being rather narrow. **Radial pore canals** short and straight and widely spaced, ten anteriorly and four posteriorly. **Muscle scars** of type A (Bate 1963), with four adductor scars in a slightly crescentic row; the second dorsal adductor is laterally elongate with the rounded antennal scar situated in front.

DIMENSIONS. Io.3995, carapace, length 0.32 mm.; height 0.20 mm.; width 0.15 mm. Io.3996, left valve, length 0.32 mm.; height 0.21 mm. Io.4011, right valve, length 0.32 mm.; height 0.20 mm. Io.4012, left valve, length 0.33 mm.; height 0.21 mm.

REMARKS. *Hekistocythere* has a distinctive combination of lophodont hinge, small, oval, posteriorly tapered carapace, type A muscle scars, and simple radial pore canals.

Family **PROCYTHERIDAE** Ljubimova 1955

Subfamily **KIRTONELLINAE** Bate 1963

Genus **EKTYPHOCY THERE** Bate 1963

Ektyphocythere parva (Oertli)

(Pl. 14, figs. 1, 3)

1959 *Procytheridea minuta* Oertli : 122, pl. 3, figs. 37-40.

1960 *Procytheridea parva* Oertli : 70.

REMARKS. Two complete carapaces represent this species, one male the other female.

When first erected, *Ektyphocythere* Bate (1963) included those species of "*Procytheridea*" which possessed, amongst other characters, a triangular arrangement of ridges as ornamentation and an antimerodont hinge. *P. parva* was one of the species included.

Subsequently Malz (1966) placed *Ektyphocythere* in synonymy with *Kinkelinella* Martin (1960) the type species, *K. tenuicostati* Martin (1960), having a reticulate ornamentation. Although considered here to be closely related the clear distinction between the forms having a triangular rather than a reticulate ornamentation is such that the retention of the former in *Ektyphocythere* is maintained here.

DIMENSIONS. Io.3982, female carapace, length 0.41 mm.; height 0.23 mm.; width 0.21 mm. Io.3983, male carapace, length 0.45 mm.; height 0.23 mm.; width 0.24 mm.

FAMILY UNCERTAIN

Genus *PLATYCYTHERE* Bate 1967*Platycythere* sp.

(Pl. 14, fig. 5)

REMARKS. Represented by a single specimen only. In outline and possession of dorsal and ventro-lateral swellings this species exhibits the generic features described (Bate 1967), but differs from *Platycythere verriculata*, the type species, by having a much finer reticulate ornamentation and a median swelling on the lateral surface of both valves. This swelling, positioned about the centre of the valve, has an oblique postero-dorsal antero-ventral inclination.

Gesoriacula Oertli (1959) has a similar external morphology but a more primitive hinge structure.

DIMENSIONS. Io.3992, carapace, length 0.35 mm.; height 0.20 mm.; width 0.16 mm.

Family CYTHERURIDAE Müller 1894

Genus *LOONEYELLA* Peck 1951

REMARKS. The type species, *Cythere monticula* Jones (1893), was described from the Cretaceous Bear River Formation, Cokeville, south-west Wyoming, in association with fresh- to brackish-water ostracods. Peck (1951), in resampling this Formation, found a new ostracod species which he considered to be congeneric with *C. monticula*, and for these two species erected the genus *Looneyella*, *C. monticula* being the type.

The preservation of Peck's material is considerably better than that of the holotype, which is in the Museum collections. The latter, I.5872, figured Jones (1893, pl. 15, fig. 13), is a complete carapace, length 0.65 mm.; height 0.40 mm.; width 0.39 mm. (inclusive of spines). The holotype is figured here (Pl. 14, fig. 6) for comparison with the Bathonian species *L. subtilis*.

To date the following species have been placed in *Looneyella*:

L. monticula (Jones) from the Upper Cretaceous Bear River Formation.

L. quadrispina Peck 1951, also from the Bear River Formation.

L. subtilis Oertli, from the Bathonian of the Boulonnais, France.

Looneyella subtilis Oertli

(Pl. 14, figs. 7, 8)

1959 *Looneyella* ? *subtilis* Oertli : 119, pl. 3, figs. 31-5.

DIAGNOSIS. Small species of *Looneyella* with prominent postero-dorsal tubercle, an antero-median tubercle somewhat smaller in size, and a marginal ridge which extends around the anterior margin and along the ventro-lateral alar extension. Both tubercles and marginal ridge are hollow when viewed internally. Antero-

medially there is a break in the continuity of the marginal ridge. Small swelling may be present below the postero-dorsal tubercle, and at the termination of the alar ridge. Shell surface smooth except for ventral surface which has four longitudinal striae per valve. Left valve larger than right. Hinge antimerodont. Species dimorphic. Eight straight anterior radial pore canals; inner margin and line of concrescence coincide. Low eye swelling occurs at the anterior cardinal angle and is connected to the anterior marginal ridge.

REMARKS. Oertli placed this species only tentatively in *Looneyella*, but comparison with the holotype of the type species convinces me that *L. subtilis* is congeneric. Dr. Oertli kindly sent me specimens of his material for comparison and enabled me to examine internal characters not available in my material.

Ecologically this is an interesting genus with the Cretaceous species recorded from sediments considered to be non-marine whilst *L. subtilis* occurs in truly marine conditions. Possibly the Cretaceous species lived under brackish-water conditions.

The material from the Upper Bathonian Bradford Clay of Bradford consists of a single female carapace in the Winwood Collection (Io.3659), and two male carapaces and a juvenile carapace (Io.3956-8) from the Fuller's Earth of Bath in the Blake Collection.

DIMENSIONS. Io.3659, female carapace, length 0.37 mm.; height 0.22 mm.; width 0.21 mm. Io.3957, male carapace, length 0.35 mm.; height 0.18 mm.; width 0.17 mm.

Genus *ORTHONOTACYTHERE* Alexander 1933

Orthonotacythere sp.

(Pl. 15, fig. 1)

REMARKS. The single specimen is a small carapace having a high caudal process, a long, straight dorsal margin and a ventral surface triangular in outline. The lateral surface is weakly reticulate but prominently ornamented by three large tubercles. The first occurs at the anterior cardinal angle and is an eye tubercle. The second occurs at the postero-dorsal part of the carapace and is somewhat elongate in outline, whilst the third is situated directly below the second at the postero-ventral corner of the carapace. This last tubercle, positioned at the end of a somewhat thickened ventro-lateral margin, extends slightly beyond the carapace posteriorly. A weak lateral ridge is present at about valve centre, but does not extend as far as the terminal margins.

Orthonotacythere nodosa Plumhoff (1963), which appears in the Lias of Germany, differs from the present species in possessing a much larger number of tubercles. *O. pulchella* Apostolescu (1959) from the Lias of France does not belong to this genus. *Orthonotacythere* sp. also differs from the small number of species described from the Upper Jurassic of the U.S.S.R. (Ljubimova 1955), Germany (Triebl 1941) and France (Donze 1960).

DIMENSIONS. Io.3993, carapace, length 0.30 mm.; height 0.15 mm.; width 0.14 mm.

Genus *PARARISCUS* Oertli 1959

Parariscus bathonicus Oertli

(Pl. 15, figs. 2, 8)

1959 *Parariscus bathonicus* Oertli : 118, pl. 2, figs. 20-29.

REMARKS. Eight complete carapaces of this interesting species are present in the Blake Collection of Fuller's Earth Ostracoda. Dr. H. J. Oertli kindly sent me comparative material.

DIMENSIONS. Io.3959, carapace, length 0.43 mm.; height 0.21 mm.; width 0.20 mm.

Genus *PARACYTHERIDEA* Müller 1894

Paracytheridea? blakei sp. nov.

(Pl. 15, figs. 4, 5, 9, 10)

DIAGNOSIS. Carapace small, reticulate, with dorso-median constriction. Postero-ventral angle swollen, extended backwards beyond margin. Eye node developed at anterior cardinal angle. Dorsal margin long, straight. Anterior end high, rounded. Posterior end narrow, triangular, situated high on carapace.

HOLOTYPE. Io.4001, carapace, Fuller's Earth, Bath.

PARATYPES. Io.4014-6, three carapaces, Fuller's Earth, Bath.

DESCRIPTION. Carapace small with coarse reticulate ornamentation. Dorso-median part of each valve with broad depression. Ventro-lateral margin swollen, particularly towards the posterior end where, at the postero-ventral angle, there is a backward projection of the carapace beyond the steeply angled postero-ventral slope. Dorsal margin long and straight with sharply angled cardinal angles. An **eye node** is situated behind the anterior cardinal angle. Anterior end high, rounded. Posterior end situated high on the carapace, sharply triangular with short, concave postero-dorsal slope and long, convex postero-ventral slope. Line of greatest length slightly above the mid-point; greatest height at the anterior cardinal angle. Greatest width in the posterior third. Left valve slightly larger than the right, which it overlaps along the ventral margin. Internal features not seen apart from the **muscle scars** which are visible from the exterior: these consist of a slightly crescentic row of four adductor scars, an antero-ventral, rounded, manibular scar, and an antero-dorsal antennal scar which is composed of two scars, the first crescentic in shape, the second rounded and fitting inside the crescent of the first. These muscle scars are situated low down on the carapace, below the dorso-median depression.

DIMENSIONS. Io.4001, holotype, carapace, length 0.30 mm.; height 0.16 mm.; width 0.14 mm.

REMARKS. *Paracytheridea? blakei* was named after J. F. Blake, in whose collection the species was found. A new genus might be preferred, but for the present it is sufficient to place the species in *Paracytheridea* on the basis of the external shape. There is no strong nodose ornamentation as in *Paracytheridea? caytonensis* Bate (1965).

Genus *CYTHERURA* Sars 1866

Cytherura bathonica sp. nov.

(Pl. 16, figs. 5-8)

DIAGNOSIS. *Cytherura* with small, elongate carapace, ornamented with slender, almost parallel, striae. Short, vertical connecting bars between striae present a slightly reticulate appearance. Posterior extremity situated above the line of the longitudinal axis.

HOLOTYPE. Io.4017, carapace, Fuller's Earth, Bath.

PARATYPES. Io.4018-9 and Io.4120, eight carapaces. Fuller's Earth, Bath.

DESCRIPTION. Carapace small, elongate, with line of greatest length very slightly above the mid-point. Greatest height at the extreme anterior end, greatest width in the posterior third. Shell surface ornamented by slender, almost parallel striae with connecting vertical bars between. A slightly reticulate appearance is thereby presented although this is subordinate to the sub-parallel striae. Dorsal and ventral margins long, straight and almost parallel. Anterior end broadly rounded, posterior end with narrow triangular margin terminally truncated and set high on the carapace: the concave postero-ventral slope is much longer than the concave postero-dorsal slope. Left valve only slightly larger than the right, overlapping it ventrally just anterior of median and at the cardinal angles. The right valve overlaps the left along the dorsal margin. Internal features not seen.

DIMENSIONS. Io.4017, carapace, length 0.30 mm.; height 0.13 mm.; width 0.10 mm. Io.4018, carapace, length 0.31 mm.; height 0.14 mm.; width 0.11 mm.

REMARKS. *Cytherura bathonica* is a true *Cytherura* as far as the external details are concerned. The presence of this species and *C. mediojurassica* sp. nov. in the Bathonian indicates that the genus was established by or during the Middle Jurassic. *C. bathonica* differs from previously described species in ornamentation although it comes close to the Recent *Cytherura striata* Sars (1866) from which it may be distinguished by the position of the posterior extremity, which is situated below the longitudinal axis in *C. striata* and above in *C. bathonica*.

Cytherura mediojurassica sp. nov.

(Pl. 15, fig. 6; Pl. 16, figs. 1, 2)

DIAGNOSIS. *Cytherura* with reticulate ornamentation. Carapace elongate, dorsal and ventral margins long, almost parallel but converging slightly towards posterior end. Short caudal process set high up on carapace.

HOLOTYPE. Io.4121, carapace, Fuller's Earth, Bath.

PARATYPES. Io.4122-38, sixteen carapaces, Fuller's Earth Clay, Bath.

DESCRIPTION. Carapace elongate with long, sub-parallel dorsal and ventral margins which converge slightly towards the posterior end. Greatest length of

carapace through the mid-point whilst the greatest height is at the extreme anterior end, through the anterior cardinal angle. Greatest width in the posterior third. Carapace slender in dorsal view. Anterior end rounded, posterior end with short caudal process set high on the carapace, slightly above the line of greatest length. Postero-dorsal slope short, concave; postero-ventral slope long and concave, although in some specimens it is slightly convex. Termination of caudal process truncated. Shell surface ornamented by a rather coarse reticulation. Occasionally a weak longitudinal stria is present in the posterior half of the carapace and extends along the longitudinal axis as far as the valve centre. This striation is really an exaggerated development of the reticulation and in the holotype is present only on the right valve. Left valve slightly larger than the right in that it overlaps the right along the ventral margin, especially along its anterior half. Dorsally, however, the right valve overreaches the left. Internal features not known.

DIMENSIONS. Io.4I2I, carapace, length 0.33 mm.; height 0.15 mm.; width 0.13 mm. Io.4I22, carapace, length 0.31 mm.; height 0.15 mm.; width 0.12 mm.

REMARKS. *Cytherura mediojurassica* sp. nov. is easily distinguished from *C. bathonica* by its strong reticulate ornamentation, and from *Cytherura? liesbergensis* Oertli (1959) by its more elongate carapace in which the dorsal and ventral margins are sub-parallel. In addition the ornamentation of *C.? liesbergensis* is weakly reticulate, with four lateral striae extending along most of the length of the carapace. These striae are not represented in the present species. Dr. H. J. Oertli kindly sent me comparative material.

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